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Understanding Public Debt For Financial Stability in ECOWAS: Do The Same Causes Produce The Same Effects?

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Abstract: The recent crises have led to an unprecedented increase in public debt worldwide, raising serious concerns about financial stability. This study aims to analyse the effect of public debt on financial stability in 15 ECOWAS member countries from 2000 to 2020. To achieve this, we use a panel smooth threshold regression (PSTR) model. The results suggest a non-linear relationship between public debt and financial stability. When public debt is below 70% of GDP, it contributes positively to financial stability. However, when it exceeds a critical level, it generates financial instability. In order to maintain financial stability, the public and monetary authorities must take into account the differential between the interest rate on public debt and economic growth.

Keywords: Public debt, financial stability, PSTR, ECOWAS

1. Introduction

After the financial crisis of 2008 and the sovereign debt crisis in the euro area in 2010, when errors in public finance figures were exposed, public debt became a major concern in the academic and political debate. It increased substantially during the Covid-19 pandemic due to the scale of the fiscal stimulus, low growth and the lowering of the central bank interest rate (Boissay et al., 2023). This

decline in the interest rate has called into question the wisdom of fiscal policies that limit the use of budget deficits to finance public spending (Blanchard, 2023). Two new trends have been observed in the world between 2007 and 2017, especially the increase in public debt and the decrease in the real interest rate. According to International Monetary Fund statistics, the amount of public debt in developed countries as a percentage of global GDP rose from 71% in 2007 to 104% in 2017. The total debt of these countries increased by 30%, reaching 225% of global GDP in 2017. This is the highest level since at least 1950.

In the same vein, the US real interest rate on 10-year government bonds has fallen from 2.5% in 2007 to 0.5% in 2017 (Ragot and Pinois, 2019). However, it should be noted that falling interest rates have ambiguous effects on bank balance sheets. On the one hand, the sustained fall in interest rates enables public authorities to increase their level of borrowing to finance their projects. And when public authorities honor their commitments on time, bank profitability rises, making the financial system more resilient. On the other hand, when this process is abruptly reversed, it leads to the deterioration of bank balance sheets, excessive asset prices, a credit crunch and bank failures (Saidane et al., 2021), generating financial instability. As a result, concerns arise and banking panics occur, leading to bank runs. Recent crises such as the Covid 19 post-pandemic, the Russo-Ukrainian war and the failure of banks (Silicon Valley Bank, Credit Suisse etc.) bear witness to this.

The increase in non-performing loans reduces the profitability and liquidity of banks, which makes them more fragile and leads to financial instability (Saliba et al., 2023). In developing countries, 2018 was a year in which the public debt situation deteriorated again and fleeting hopes for improvement, fuelled by soaring financial markets and optimistic forecasts, were largely dashed. The total external debt stock of developing countries and economies in transition more than doubled from $4.5 trillion in 2009 to $9.7 trillion in 2018, an average increase of 8.7% per year[1]. In the ECOWAS area, public debt continues to accumulate, rising from 36.6% of GDP in 2018 to 39.2% in 2019. It varies from one country to another from 28.4% (Nigeria) to 128% (Cape Verde). But it exceeds 50% of GDP in 11 ECOWAS[2] economies and averages 62% across the WAEMU[3].

The sovereign risks are a source of fragility in the financial system due to the significant deterioration of the economic outlook, the depreciation of sovereign debt portfolios and financing problems. These elements act as catalysts and can accelerate the emergence of problems in the financial system (Angelini et al., 2014). High public debt creates financial instability (Borio et al., 2020) through several channels. It hinders production and the ability of firms and households to borrow from banks, which reduces the profitability and solvency of banks. It also crowds out private sector investment, which raises the marginal product of capital and, in turn, all interest rates, whether risky or safe, by a certain amount (Laeven and Valencia, 2018). However, when financial institutions raise their minimum credit standards, it becomes more difficult for borrowers to obtain funds, which slows economic growth and reinforces financial fragilities. The evolution of public debt remains surrounded by considerable uncertainty. The effects of previous crises persist. Inflation and indebtedness continue to soar. Cyclical factors aggravate the already difficult financial situation, leading to liquidity crises and funding shortages.

In previous literature, there was no consensus on the link between public debt and financial stability. The first strand of the literature concerns the study of a positive linear relationship between public debt and financial stability. It is in this configuration that Blanchard (2019) points out that high public debt can be beneficial for well-being. It contributes to macroeconomic and financial stability when

[1] See the report United Nations report in 2019, External debt sustainability and development

[2] The Economic Community of West African States (ECOWAS) has 15 member states : Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Senegal, Sierra Leone and Togo.

[3] WAEMU is the acronym for the West African Economic and Monetary Union. It comprises eight countries: Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo.

the economy's growth rate is higher than the interest rate (Artus, 2022). The second strand of the literature concerns the analysis that financial instability is associated with a sustained increase in public debt (Reinart and Rogoff, 2010). Empirical work has also produced mixed results (Tagkalakis, 2013). These contradictory results show that there is probably a non-linear relationship between public debt and financial stability.

To analyze this non-linear relationship, we use the PSTR model originally developed by González et al. (2005), determining the optimal level of public debt below and above which financial stability is affected. There are at least two reasons for using such a model in this study. Firstly, the PSTR model allows individuals to move from one group to another over time according to changes in the threshold variable, which in our case is public debt. In addition, the model takes into account the heterogeneity of the data, which can be fully captured by means of individual effects (fixed or random) and time effects, so that the coefficients of the observed explanatory variables are identical for all observations (Gonzalez et al., 2005). The parameter coefficients also can take on different values, depending on the value of another observable variable (Pesaran, 2015). Finally, insofar as PSTR is a regime-switching model, the transition from one regime to another is smooth rather than discrete, making it adaptable to our purpose. To our knowledge, no study in the ECOWAS area has previously applied the PSTR model to the subject under consideration, although it seems highly relevant.

This research work is an extension of the previous literature on the link between public debt and financial stability. It makes three significant contributions. First, we argue that moderate public debt can help avoid a sustained slowdown in economic growth and enhance financial stability. For example, in response to the Covid 19 pandemic, governments were quick to play a supporting role in the real economy. This is likely to have prevented the secular stagnation and recession that would otherwise have exacerbated the damage to the economy. Second, when public debt exceeds a critical level, the credibility of the sovereign state is less assured in the eyes of international investors, which can lead to greater volatility due to difficulties in refinancing public debt, which in turn can lead to macroeconomic instability and, by extension, financial instability. Third, the implementation of an economic and monetary integration project in the ECOWAS area requires an optimal level of public debt below and above which financial stability is affected.

The general objective is to analyse the effect of public debt on financial stability. More specifically, the aim is, first, to determine the optimal level of public debt; second, to determine the effect of public debt on financial stability below an optimal level; and third, to determine the effect of public debt on financial stability above an optimal level.

The rest of the study is structured as follows. The second section provides a review of the literature. The third section presents the data description. The fourth section provides the econometric model. The last section presents the conclusion.

2. Literature review

The link between public debt and financial stability has been the subject of particular debate in policy and academic circles. Mixed results have been observed from both theoretical and empirical perspectives. The two should inform each other. Debt is a very complex contract. It involves a promise to repay the principal and interest of a loan or advance. A promise whose fulfilment is by nature uncertain and varies from borrower to borrower (Davis, 1995). This literature offers significant insight into its sustainability (Dahlby and Ferede, 2023; Boissay et al., 2023). Indeed, debt financing has a fundamental influence on welfare and economic growth, and managing the associated risks is a key determinant of financial stability.

For Kumhof and Tanner (2005), public debt contributes to financial stability, especially as a regular flow of profits from government bonds can strengthen the resilience and solidity of banks' balance sheets. In the same vein, assessing the link between the banking sector and sovereign risk, Aktug et al (2013) show that a dynamic financial system is associated with higher sovereign credit ratings.

They conclude that bank balance sheets are significantly related to sovereign credit ratings. Alcidi and Gros (2019) show that countries with high debt levels often pay a risk premium. According to the authors, Italy represents a typical representation of a negative loop where a high level of debt, combined with rising deficits, leads to a higher risk premium and therefore higher refinancing costs. On the other hand, Portugal, with its moderate reduction in budget deficits, has improved the outlook for future debt levels to such an extent that the risk premium has fallen to less than half the Italian level, thereby reducing the burden of interest payments.

For Blanchard (2019), a high level of public debt can be beneficial to well-being. It is a source of finance and brings many benefits. It also plays an important role for growth, raises funds for long-term development projects and strengthens the resilience of the financial system and, consequently, financial stability. However, in extreme circumstances, debt vulnerabilities can affect financial stability by precipitating significant disruptions and altering the functioning of the financial system. Other authors have supported this analysis. Tagkalakis (2013) highlights the link between financial stability and public debt. By controlling several macroeconomic variables, the author concludes that a fragile banking system can jeopardize public finances. Low bank profitability, poor asset quality and a weak capital base increase the fragility of the banking system, which increases the likelihood of future fiscal problems. As part of the analysis of bank lending activities, Makri et al (2014) point out that banks are generally exposed to the probability of a fall in loan repayments. The increase in non-performing loans, considered as financial pollution with harmful effects, causes an increase in capital requirements to cover potential losses. Substantial non-performing loans erode banks' profitability. Banks thus become more fragile and less profitable, while bank failure and financial crisis are quite possible. For Cooper and Nikolov (2018), the fragility of sovereign debt is due to a strategic complementarity between buyers of government bonds, operating through a default by the state. In this case, the State's ability to repay its debt depends inversely on the real interest rate it has to pay. The possibility of self-fulfilling pessimistic equilibria arises when the high interest rate required to compensate bondholders for losses incurred on financial markets is higher than the real interest rate. Gros and Alcidi (2019), at a high level of debt, the cost of debt in terms of interest rates is greater, not only because there is more debt to service, but also because the cost of each unit of debt increases. This means that with higher interest payments, the level of debt increases further, unless the country in question starts to generate a much larger primary surplus. With a constant primary surplus, the feedback loop between debt and risk premia can therefore be unstable in both directions.

Other external factors can jeopardize its viability, even if the debt-financed investment goes ahead as planned. Adverse exchange rate fluctuations caused by capital outflows are an obvious example, as they exacerbate the effects of the mismatch between local currency tax revenues and foreign currency debt, and make debt servicing more difficult. These fluctuations could even make borrowing more expensive ex ante, if investors take this risk into account (Eichengreen et al., 2003). The same scenario occurs in periods, most often described as expansions. These periods lead to a kind of moral hazard by structurally underestimating risks. These periods are sometimes followed by a crisis. During these crises, banks reduce their lending due to the imposition of strict standards by regulators and the increased importance attached by markets to bank capital (Sharpe, 1995). The credit crunch intensifies. Creditworthy borrowers cannot obtain credit or cannot obtain it on reasonable terms, and lenders are excessively cautious, which may be explained by regulatory constraints. Potential borrowers will then be unable to finance their investment projects (Yuan and Zimmermann, 1999).

However, it is important to stress that despite the wide variety of explanations for public debt, no unified theoretical and empirical proposal has yet been formulated. Empirical studies have been carried out on the link between public debt and economic growth (Reinarth and Rogoff, 2010), on fiscal spillovers (Alloza et al., 2019) and on the interaction between fiscal policy and monetary policy (Smets and Trabandt, 2012). To our knowledge, no study has analysed the non-linear relationship between public debt and financial stability in ECOWAS. We thus support the argument that public

debt has a positive influence on financial stability up to a certain level; above a critical level, the negative effects prevail and lead to financial instability. In this paper, we test this assertion and empirically identify such a threshold.

3. Data description

In this section, the first issue to be resolved is the measurement of financial stability. Second, we define the independent variables.

Financial stability

Research has been used in one or more countries to measure financial stability (Babar et al., 2019). Authors such as De Band et al. (2021) point out that financial stability does not have a generally recognized measure, but rather an indicator[4]. The IMF (2008) has developed internationally accepted indicators for measuring financial stability based on the framework for monitoring financial institutions, known as the CAMELS (Capital adequacy, Assets quality, Management, Earning, Liquidity and Sensitivity) approach[5]. The CAMELS approach makes it possible to assess and cover the main financial and non-financial risks faced by financial institutions. However, there is no static measure of financial stability, but rather a continuous and quantifiable measure (Illing and Liu, 2006). Indicators such as the z-score, net interest margin, non-performing loans, profitability and solvency of banks are also used in previous literature as a measure of financial stability. Our study is part of this approach.

Independent variables

This study presents the main independent and control variables. The control variables are chosen with reference to previous literature.

- Public debt (independent variables)

Total debt servicing (% of exports of goods, services and income): For an adequate measure of public debt, Kronick and Ambler (2022) suggest that total debt service is a better indicator of financial difficulties than measures based on debt ratios. It corresponds to the sum of capital repayments and interest actually paid in foreign currency, goods or services on long-term debt, interest paid on short-term debt and repayments (redemptions and fees) paid to the IMF. This study introduces the total debt service ratio to analyses the link between public debt and financial stability.

Central Government Debt (Percent of GDP): refers to the total stock of direct fixed-term contractual obligations of the government to others that are outstanding on a given date. Debt sustainability depends on the hierarchy between the rate of economic growth and the interest rate on public debt (Artus, 2022). In fact, an increase in debt can result either from an increase in public spending, an increase in public investment, a reduction in tax revenues or other budgetary changes. It can contribute to the solvency of governments, but when governments default, non-performing loans increase and profitability decreases, affecting financial stability (Orphanides, 2021).

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[4] An indicator is a qualitative or quantitative variable that provides a simple, reliable means of expressing a result. It is different from a measurement. A measure is a number that records a directly observable value or performance.

[5] The CAMELS rating system, originally developed by the Federal Deposit Insurance Corporation (FDIC) in the US, is designed to assess the performance and overall condition of banks by examining six key measures: capital adequacy ratio, non-performing loan ratio, average return on equity, liquidity ratio and market sensitivity. Officially called the Uniform Institutional Rating System, it was developed in 1979 and was then referred to only as the CAMEL rating system. In 1996, the sixth component of sensitivity was added. In some cases, this component is not taken into account in the research papers or is replaced by another measure that can be calculated using financial ratios, such as size. The rating of each bank is confidential and is only communicated to senior management, as a drop in rating may represent a risk to the stability of banks and may eventually lead to a run-on bank.

External debt stocks (% of GNI): The most relevant measure of repayment capacity depends on the most binding constraints in a given country. Ratios of outstanding debt in relation to measures of repayment capacity are indicators of the burden represented by a country's future obligations and therefore reflect the long-term risks to solvency. It is the sum of public and publicly guaranteed long-term debt, private non-guaranteed debt, the use of IMF credits and short-term debt (Adam and Bevan, 2005).

- Additional control variables

We follow the existing literature to select the control variables. We control for the degree of financial development by adding domestic credit provided by the private sector and money supply to GDP.

Domestic credit provided by the private sector: is defined as the credit provided by financial intermediaries, excluding top-tier banks, to the private sector relative to GDP. It is used as a measure of financial depth (Levine and Zervos, 1996). However, it has been shown that countries with higher levels of private credit relative to GDP and money supply relative to GDP experience faster growth and higher rates of poverty reduction (Beck et al., 2000), which reinforces financial stability.

Inflation: as measured by the consumer price index reflects changes in the cost of a basket of goods and services purchased by the average consumer. The contents of this basket may be fixed or changed at regular intervals, in particular each year. The expected sign of this variable is negative, but as Uhde and Heimeshoff (2009) point out, the effects of the inflation rate are theoretically ambiguous

Trade openness: is the sum of exports and imports of goods and services measured as a percentage of gross domestic product. Similarly, the rapid growth of the financial sector is linked to the presence of a favorable institutional environment and to technological progress. Thanks to the adoption of liberal trade and financial policies, combined with technological progress, the expansion of international trade and the financial sector was an important engine of growth after the Second World War .

Population growth: according to the World Bank's definition, the annual population growth rate for the year is the exponential rate of population growth at mid-year for the year to , expressed as a percentage. The population is based on the de facto definition of population which counts all residents regardless of their legal status or citizenship.

Government: Political stability is defined as a measure of perceptions about the likelihood of government being destabilized or overthrown by unconstitutional measures including domestic violence and terrorism. One of the most relevant areas that has been affected by changes in political stability is the banking sector, with ongoing news in the media reporting on the state of the aforementioned sector and how it is shaping a new paradigm of the global economy. Consequently, over the last decade, the role of political stability as a driver of international capital flows has become an important area of research.

Life expectancy at birth, total (years): Life expectancy at birth indicates the number of years a newborn baby would live if the mortality rates prevailing at the time of birth remained the same throughout its life. A large body of literature studies the effect of life expectancy on economic development. There is no consensus among the authors on the increase in life expectancy. For some, an increase in life expectancy can reduce capital-labour ratios, which in turn reduces economic growth and increases financial vulnerability. Others point out that an increase in life expectancy can lead to a quantity-quality exchange where parents have fewer children but invest more in their children's education and their own (Cervellati and Sunde, 2007).

Mobile cellular subscriptions (per 100 people): We also include subscriptions to mobile telephone services, which are defined in the World Bank database as subscriptions to a public mobile telephone service providing access to the public switched telephone network using cellular technology. Bedi (1999) suggests that reliable information communication technologies can improve the quality of

information by providing up-to-date and complete data. With more and better information, people in developing countries will be able to make better and faster decisions to facilitate economic growth and development and reduce poverty. This is what makes the financial system stronger and more resilient.

4. Estimation strategy panel data

To find the appropriate estimation technique, we use cross-sectional dependence, unit root, Wooldridge autocorrelation and Breusch-Pagan heteroskedasticity tests. These tests are important for fitting panel data (De Hoyos and Sarafidis, 2006), as the time dimension of our study (2000-2020, T=21 years) exceeds the individual dimension$(N = 15)(T > N)$. To this end, we first present the cross-sectional dependency test according to the method of Pesaran (2015). This cross-sectional dependence test reveals that the null hypothesis of no cross-sectional dependence between all panel countries is not rejected, and the errors are weakly dependent (see Table 1).

Table I : Cross-sectional dependency test

Pesaran (2015) test for weak cross-sectional dependence.
H0: errors are weakly cross-sectional dependent.
CD = 0.569 p-value = 0.569

There is therefore a cross-sectional dependency between the underlying variables, whatever the sample. We then perform the Pesaran (2007) unit root test to verify the stationarity of the variables. The table II shows the unit root results.

Table II: Unit root test

Variables	Statistic	Decision
Zscore	-1.4921***	I(0)
Car	-3.2024 ***	I(0)
Nim	-4.1251 ***	I(0)
Roa	-4.4710 ***	I(0)
Servdebt	-3.4415 ***	I(0)
Debtgdp	-6.5391***	I (1)
Exdeb	-6.8815***	I(1)
Tlifexp	-3.1674***	I(1)
Credit	-9.0275 ***	I(1)
m2gdp	-8.1853***	I(1)
Inf	-6.3378 ***	I(0)
Trade	-1.6675 **	I(0)

Variables	Statistic	Decision
Pop	-5.0663***	I(1)
mob_cel	-5.5156***	I(1)
Gov	-7.8771***	I(1)
Ccorrupt	-8.2990***	I(0)
Gov-eff	-1.8277***	I(0)
P-stab	-2.2802**	I(0)
Regq	-1.8679**	I(0)
Rulaw	-1.3121*	I(0)
Voiceacc	-8.4753***	I(1)

The stationarity test takes cross-sectional dependence into account. The result rejects the null hypothesis and shows that all the variables examined are stationary in level and first difference. Finally, we examine the Wooldridge autocorrelation test and the Cook-Weisberg test for within-panel heteroscedasticity. The Wooldridge test for autocorrelation in panel data detects first-order autocorrelation in the errors of a panel data model. The test is based on the residuals of the first-difference regression of the dependent variable on its lagged values. The table III shows the results of the test.

Table III: Wooldridge test for autocorrelation in panel data

Wooldridge test for autocorrelation in panel data
H0: no first order autocorrelation
F(1, 14) = 69.414 Prob > F = 0.0000

The table III shows that the null hypothesis of no serial correlation is strongly rejected. Furthermore, the output of the first-difference regression includes standard errors that account for clustering within panels. As Baltagi and Baltagi (2008) argues, if there is serial correlation in the idiosyncratic error term, panel-level clustering will produce consistent standard error estimates, and other estimators will produce more efficient estimates. The Breusch-Pagan / Cook-Weisberg test tests the null hypothesis that error variances are all equal against the alternative hypothesis that error variances are a multiplicative function of one or more variables.

Table IV: Breusch-Pagan / Cook-Weisberg test for heteroscedasticity

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
chi2(1) = 0.11 Prob > chi2 = 0.7346

The result reveals that the null hypothesis is not rejected, indicating that the error variances are all equal. Moreover, the chi-square value is low, implying that heteroscedasticity is probably not a problem (or at least that if it is a problem, it is not a multiplicative function of the predicted values). These tests play a crucial role in the adjustment of panel data models. In this respect, the panel data

structure is respected. The results obtained from table I appendix present the descriptive statistics and the correlations between the variables (table II, appendix).

Panel data model

Following Baltagi and Baltagi (2008), panel data regression differs from regular time series or cross-sectional regression in that the variables include a double index, i.e.

$$Y_{it} = \alpha_{it} + X'_{it}\beta_{it} + u_{it} \quad i = 1, \dots, N \quad ; t = 1, \dots, T \qquad (1)$$

Where Y_{it} is the dependent variable for country i at time t, X_{it} is a vector of dimension $(KX1)$ containing the explanatory variables, β denotes the vector of coefficients of the explanatory variables and α is a scalar. The index i denotes the cross-sectional dimension and t the time dimension.

Table V : Result of effect of public debt on financial stability

Explanatory variables	(1)	(2)	(3)	(4)
Servdebt	0.253***	0.295***	0.317***	0.274***
	(0.0899)	(0.0878)	(0.0943)	(0.0948)
Credit	0.937***	0.920***	0.490***	
	(0.165)	(0.150)	(0.147)	
Pop	8.313***	7.717***	8.252***	9.122***
	(1.266)	(1.257)	(1.290)	(1.297)
Tlifexp	-0.204	-0.144	-1.824***	-1.086***
	(0.361)	(0.351)	(0.252)	(0.195)
Inf	0.330***			0.533***
	(0.127)			(0.129)
mob_cel	-0.167***	-0.195***		
	(0.0302)	(0.0285)		
m2gdp	-0.0812			
	(0.121)			
Trade	0.0247	0.0224		
	(0.0257)	(0.0259)		
Gov	-2.228	-2.534		
	(1.579)	(1.588)		
Constant	-9.574	-10.34	83.84***	42.69***
	(19.65)	(19.53)	(14.22)	(12.62)
Observations	313	313	313	313
R-squared	0.410	0.395	0.292	0.305
Number of pays	15	15	15	15

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table VI : Result of effect of public debt on financial stability

	Return on Assets		Capital adequacy		Net interest margin	
Explanatory variables	(1)	(2)	(1)	(2)	(1)	(2)
Debtgdp	0.049**	0.049**	0.069***	0.062***	-0.049**	-0.049**
	(0.0244)	(0.0243)	(0.0170)	(0.0150)	(0.0202)	(0.0203)
Tlifexp	0.102	0.0726	0.319		0.109	0.0914
	(0.410)	(0.401)	(0.285)		(0.135)	(0.151)
Credit	0.945***	0.920***	-0.0137	-0.0853	-0.263	-0.267
	(0.166)	(0.149)	(0.116)	(0.103)	(1.061)	(1.063)
m2gdp	-0.0411		-0.133		0.00946	0.00832
	(0.121)		(0.0843)		(0.0258)	(0.0262)
Inf	0.357***	0.354***	-0.0420	-0.0397	-0.522	-0.539
	(0.127)	(0.126)	(0.0886)	(0.0868)	(0.336)	(0.343)
Trade	0.0253	0.0248	-0.0195	-0.0181	-0.0628	-0.0754
	(0.0259)	(0.0258)	(0.0180)	(0.0176)	(1.341)	(1.344)
Pop	8.537***	8.528***	0.106	0.00953		0.0265
	(1.275)	(1.273)	(0.887)	(0.885)		(0.102)
mob_cel	-0.182***	-0.184***	0.0335	0.0409***	0.0554	0.0530
	(0.0314)	(0.0310)	(0.0219)	(0.0146)	(0.105)	(0.106)
Gov	-2.415	-2.426	3.822***	3.984***	0.0100	0.00960
	(1.601)	(1.599)	(1.114)	(1.087)	(0.0215)	(0.0216)
Constant	-29.12	-28.04	-3.043	13.03***	38.49**	39.12**
	(23.04)	(22.78)	(16.02)	(2.963)	(18.98)	(19.16)
Observations	313	313	312	312	309	309
R-squared	0.402	0.402	0.136	0.127	0.024	0.025
Number of pays	15	15	15	15	15	15

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The results in tables V and VI show that public debt makes a positive contribution to bank stability. It increases the profitability and solvency of banks, but at a critical level, it can hinder the financial system due to the vicious circle that links the solvency of banks and the solvency of governments. To do so, we use the PSTR.

PSTR model

The empirical PSTR model can be written as follows:

$$FST_{it} = \alpha_i + \beta_0' Pubdett_{i,t} + \beta_1' Pubdett_{i,t} g(q_{i,t}; \gamma, c) + \theta_i' Z_{i,t} + \varepsilon_{i,t} \quad (2)$$

$i = 1, \cdots, N$ and $t = 1, \cdots, T$.

Where N and T denote the cross-sectional and temporal dimensions of the panel, respectively. FST_{it} is the financial stability indicator, $Pubdett$ the public debt and $Z_{i,t}$ a vector of control variables usually considered in previous literature. α_i represents individual fixed effects, and $\varepsilon_{i,t}$ is the error term. The transition function $g(q_{i,t}; \gamma, c)$ is continuous and depends on the threshold variable $q_{i,t}$ and c, which is the localization parameter. Finally, the parameter γ determines the slope of the transition function. Based on Granger et al. (1993) and González et al. (2005), we consider the following logistic transition function:

$$g(q_{i,t}; \gamma, c) = \left[1 + exp\left(-\gamma \prod_{j=1}^{m} (q_{i,t} - c_j)\right)\right]^{-1} \quad (3)$$

Our approach can be broken down into two main stages: first, we test linearity. Next, we present the results of the PSTR model estimation.

Table VII : Linearity test result: linear model versus PSTR model

Tests	**Model 1**		**Model 2**	
	Statistics	Probability	Statistics	Probability
Wald test	43.398	0.000	30.745	0.000
Fisher test	5.166	0.000	3.497	0.000
Maximum likelihood test	46.694	0.000	32.350	0.000

Source: Author, based on World Bank data

The test results in this table VII suggest that there is a non-linear relationship between public debt and financial stability. Indeed, the alternative hypothesis of non-linearity is not rejected, indicating that the equations need a transition function. The transition function implies that there is a threshold above which the effect of public debt on financial stability may be unfavorable.

Table VIII : Estimation of the PSTR model with total Public debt as a threshold effect

	Equation 1		Equation 2	
Variable	Stage 1	Stage 2	Stage 1	Stage 2
Debt service	-0.1487	-0.3448**	0.0285	-0.3502**
	(-1.0729)	(-1.9801)	(-0.8050)	(-2.0526)
Dcredit	0.2701***	0.1492	0.2646***	0.1449
	(2.8072)	(0.9217)	(2.839)	(0.966)
Inflation	0.1231	-0.5972***	0.1342	-0.6009***
	(1.3783)	(-3.8464)	(1.491)	(-4.0231)

	Equation 1		Equation 2	
Variable	Stage 1	Stage 2	Stage 1	Stage 2
Population	-1.4561**	3.4385***	-1.3414**	3.2676***
	(-2.0664)	(3.6314)	(-1.979)	(3.578)
Gov	0.8916	-0.8795		
	(1.0862)	(-0.5007)		
Trade	0.0377***	-0.0891*	0.0407***	-0.093*
	(3.2012)	(-1.8744)	(3.3210)	(-1.958)
LEX_Birth	0.2205*	-0.0762	0.222*	-0.0591
	(1.9179)	(-0.8505)	(1.9099)	(-0.679)
M2/GDP	-0.2853	0.2794**	-0.282***	0.2594**
	(-3.9338)	(2.5435)	-3.8183	(2.316)
External Debt	-0.0149**	0.0245	-0.0189***	0.0325**
	(-2.3983)	(1.5645)	(-3.539)	(2.295)
γ	71.8659		70.6790	
c	0.0648		0.0632	
BIC	2.927		2.888	
RSS	3810.179		3824.635	
AIC	2.689		2.673	

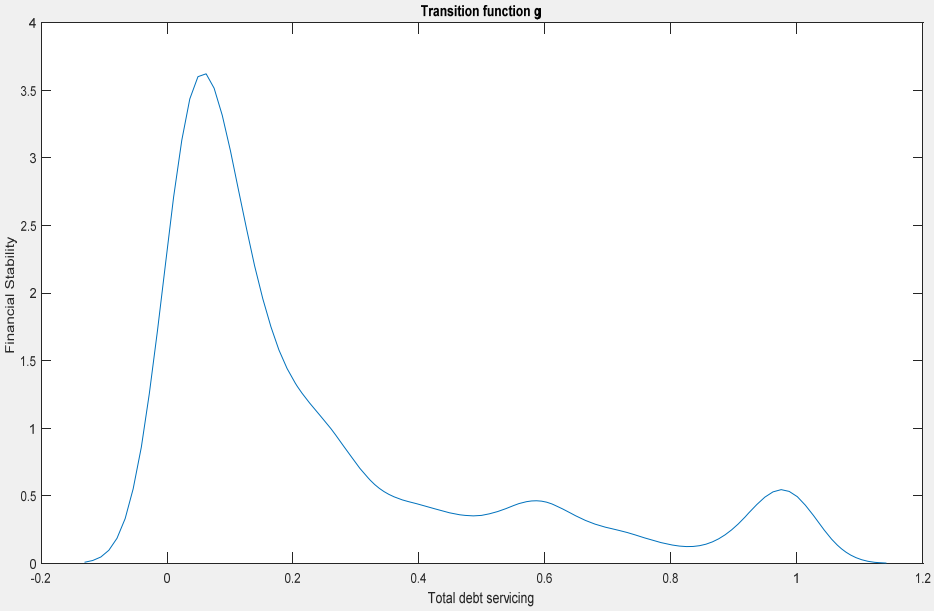
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The criteria mentioned in table VIII the estimated variables are as follows: AIC, BIC, $SBIC$ et γ [6].

[6] The Akaike AIC criterion is defined as follows: $AIC = \log\left(\frac{rss}{N*T-nbparam-1}\right) + 2 * \frac{nbparam}{N*T}$

Where nbparam is the number of parameters. It is calculated as follows: $nbparam = k * (r + 1) + r * m + 1$.. N is the number of observations. T is the number of peridoe. N*T is the total number of observations. The Bayesian information criterion BIC or Schwarz criterion (alsoSBC, SBIC) is a criterion for selecting a model from a finite set of models. It is based in part on the likelihood function and is closely related to the Akaike Information Criterion (AIC). It is calculated as follows: $BIC = log(rss/(N * T - nbparam - 1)) + 2 * nbparam/((N * T) * log(N * T))$. With $BIC = \log\left(\frac{rss}{N*T-nbparam-1}\right) + 2 * \frac{nbparam}{(N*T)*\log(N*T)}$ The results show that γ . This shows that the logistic function is a continuous function. Consequently, the model becomes a non-linear model, in this case the Panel Smooth Threshold Regression (PSTR) model

- Curve of the function of g[7]



Intepretation of results

The estimated parameters of the PSTR model are shown in the table VIII. Three main conclusions can be drawn from this table. Firstly, the results reveal that the relationship between public debt and financial stability is non-linear. In the expansion phase, there is deleveraging, which leads to stability in the banking sector. After the expansion, we enter the second phase (ultimate phase). At this level, our results reveal an optimal threshold of 70% for public debt. Beyond this threshold, continued public debt or excessive public debt is no longer conducive to financial stability. In this case, public debt becomes unstable and generates imperfections in the financial system. The results of this research show that public debt has a favorable effect on financial stability, but that this effect decreases at a critical level. The coefficient associated with the public debt variable has positive and significant effects on financial stability. Above a critical threshold, i.e. 70% of public debt, public debt only generates financial bubbles and leads to financial instability. Financial instability can increase the cost of financing business and household spending, leading to a slowdown in economic growth. What's more, such an increase in the cost of financing can lead businesses and households to cut back on spending and economic growth. Overall, the results obtained in this research suggest that public debt has a positive impact on financial stability, but this effect is diminishing and becoming negative. Better supervision and monitoring of the financial system could help contain its negative effects on economic growth.

The financial instability is accompanied by instability in real and financial asset prices. This phenomenon is often referred to as a financial bubble and is characterized by three phases. The first begins with financial liberalization, or a decision by the central bank to significantly increase credit to the economy. Secondly, the expansion of credit drives up asset prices, fuelling financial bubbles. Finally, the exposure of these bubbles only generates financial instability. The manifestation of

[7] This transition function is normalized to be bounded between 0 and 1 and is mathematically materialized as follows: $0 \leq g(q_{it};\ \gamma, c) \leq 1$

financial instability leads to bankruptcies of companies or other economic agents that have borrowed to pay for inflated asset prices. Academic conclusions have been put forward to solve the problem of debt and development. Politicians agree on one point of view. Solving the debt problem takes priority over prudence and gradual change. In other words, an effort is needed to sequence debt resolution before development. This remark draws a parallel between the fight against the Covid 19 pandemic and broader issues of global equity and justice. Similarly, there is a need for priority areas of action that could address macroeconomic imbalances in the context of financial constraint, such as rebalancing public accounts and strengthening public financial management in a context of tightening financial conditions.

5. Conclusion

In the wake of the COVID-19 pandemic and the outbreak of war between Russia and Ukraine, most ECOWAS member countries find themselves in a difficult situation. This dual crisis is jeopardizing the development progress of member countries, and may also turn into a debt crisis. During the Covid 19 pandemic, one observation was made. Unconventional monetary policies played a spectacular role. But just over a year after the Covid 19 pandemic, a new situation has emerged. Public debt and inflation have soared and a shortage of financing has set in. Faced with this situation, other measures have been taken by most central banks, all the more so as highly improbable random events seem to be skewing previous measures.

The result shows that the relationship between public debt and financial stability has the shape of a trough curve. In fact, public debt is positively linked to financial stability when it is at a moderate level. However, when it reaches its optimal level, the relationship reverses and becomes negative. High debt servicing costs prevent economies from spending more on essential services and investments needed to improve economic resilience, poverty reduction and financial soundness. The ECOWAS economies continue to experience significant shocks from the effects of the Covid 19 pandemic and post-pandemic, including the fallout from geopolitical tensions, the potential collapse in export commodity prices associated with high food and energy prices, continued exchange rate depreciation and declining international donor support. In the wake of these developments, a series of questions are now superimposed on the difficulties associated with these macroeconomic imbalances, climate and financial risks. These risks are likely to generate income inequalities, budget deficits, trade deficits, falling output and rising public debt.

ECOWAS economies are increasingly borrowing on commercial terms, increasing their exposure to interest rate and exchange rate risks. The risks associated with debt refinancing are high, as repayments of substantial amounts of external debt soar. High levels of indebtedness sometimes generate financial instability due to the default of certain states, political instability, high levels of non-performing loans and greater slippage during election years. Economic policy implications must be taken into account by public and monetary decision-makers, in the face of high levels of public borrowing and liquidity crises. To achieve this, they must take measures to improve the business climate and limit climate risks. In addition, public spending should be prioritized in sectors with high social and private returns, such as infrastructure, education and healthcare, in line with sustainable development objectives.

We emphasize the need for regulators to develop a proactive policy framework to address public debt management and financial stability, given the vicious circle linking government solvency and bank solvency. Improving debt transparency is also essential to reduce financial vulnerability. Governments need to provide more granular and timely information on debt, including exposure to risks associated with interest rates, exchange rates and refinancing. Such transparency would enable budgetary risks to be properly assessed, invite closer scrutiny and potentially reduce recourse to non-traditional debt instruments. It is also more interesting to integrate government or regulatory action where debt reduction and climate change mitigation and adaptation are to be achieved with two birds with one stone.

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7. Appendix

Tabel I: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Financial Stability (dependent Variable)					
Z-score	315	11.35362	6.475328	-2.55	27.95
Capital adequacy (CA)	312	15.74108	9.465498	-13.7	53.3
Net interest margin (NIM)	303	7.88769	8.26952	-32.98	33.71
Return on Asset (ROA)	311	9.661704	15.94807	-32.95	78.5
Independent Variables					
Total debt service (% of exports of goods) (servdebt)	315	8.718619	8.16145	.41	63.15
debt-to-GDP ratio (debtgdp)	315	53.89851	36.07144	7.28	217.14
External debt stocks (% of GNI) (External debt)	315	63.10044	76.43879	4.95	610.45
Control Variable					
Financial develppment					
Private credit to GDP (credit)	315	14.40368	11.8541	0	65.82
Money supply (% of GDP) (m2gdp)	315	27.69981	16.81875	5.21	113.65
Inflation (Inf)	315	6.177016	7.415496	-3.5	41.51
trade openess (Trade)	315	65.91359	34.95147	20.72	311.35
Population (Pop)	315	2.675397	.6807303	.8	5.79
Mobile cellular subscriptions (mob_cel)	315	49.15394	40.65159	0	149.54
Life expectancy at birth, total (years) (Tlifexp)	315	58.19587	5.938893	45.05	76.59
Gouvernance (Gov)					
Control of Corruption (Ccorrupt)	315	-.6028446	.5374127	-1.58114	1.127157
Government Effectiveness (Gov-eff)	315	-.8200355	.4414098	-1.79194	.355627

Political Stability (P-stab)	315	-.5343074	.8307365	-2.40335	1.2236
Regulatory Quality (Regq)	315	-.6470647	.3790827	-1.85597	.168184
Rule of Law (Rulaw)	315	-.6668305	.5366938	-1.88087	.662211
Voice and Accountability (Voiceacc)	315	-.3256694	.5902339	-1.45968	.974187

Table II: Correlation coefficients

	Z-score	CA	NIM	ROA	Servdebt	Debtgdp	External debt	Tlifexp	Credit	M2gdp	Infl	Trade	Pop	mob-Cel	Ccorrup	Gov-eff	P-stab	Reg	rulaw	Voiceacc
Z-score	1																			
CA	-0,10	1																		
NIM	0,12	0,16	1																	
ROA	-0,15	0,27	0,18	1																
Servdebt	-0,05	0,00	-0,08	0,11	1															
Debtgdp	-0,24	0,35	-0,13	0,23	0,10	1														
External debt	-0,38	-0,06	-0,14	0,03	0,04	0,45	1													
Tlifexp	0,11	-0,03	-0,01	-0,08	0,01	0,05	-0,14	1												
Credit	0,31	-0,25	-0,07	-0,16	0,08	0,03	-0,17	0,77	1											
m2gdp	0,10	-0,02	-0,10	-0,01	0,07	0,25	-0,12	0,81	0,85	1										
Infl	-0,22	0,16	0,09	0,50	0,00	0,04	0,15	-0,21	-0,33	-0,24	1									
Trade	-0,21	-0,06	-0,01	0,05	-0,17	0,04	0,46	0,33	0,19	0,20	0,17	1								
Pop	-0,05	-0,01	0,09	0,04	0,04	-0,29	-0,01	-0,44	-0,47	-0,56	-0,13	-0,11	1							
Mob-Cel	0,30	0,10	-0,03	-0,22	0,06	-0,16	-0,32	0,49	0,39	0,42	-0,18	0,00	-0,20	1						
Ccorrupt	0,15	-0,06	0,00	0,06	0,19	0,08	-0,08	0,74	0,73	0,68	-0,19	0,19	-0,32	0,14	1					
Gov-eff	0,30	-0,10	0,07	0,11	0,20	-0,02	-0,19	0,64	0,59	0,52	-0,10	-0,02	-0,26	0,14	0,83	1				
P-stab	-0,07	0,09	0,01	0,06	-0,01	0,20	-0,13	0,53	0,34	0,47	-0,22	0,11	-0,22	-0,07	0,62	0,55	1			
Regq	0,35	-0,12	0,06	0,01	0,23	-0,17	-0,39	0,55	0,56	0,43	-0,23	-0,11	-0,15	0,19	0,77	0,86	0,54	1		
Rulaw	0,19	-0,08	0,09	0,06	0,14	-0,03	-0,21	0,70	0,65	0,59	-0,22	0,09	-0,23	0,10	0,89	0,87	0,70	0,85	1	
Voiceacc	0,19	-0,04	0,10	-0,09	0,00	-0,04	-0,15	0,59	0,58	0,52	-0,17	0,20	-0,20	0,13	0,76	0,72	0,62	0,65	0,80	1