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Public Debt and Tax Revenues in the West African Economic and Monetary Union (WAEMU) Countries: The Role of Human Development

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Abstract: This study aims to examine the role of human development in the relationship between public debt and tax revenues in the West African Economic and Monetary Union. Using econometric models with the panel-corrected standard error (PCSE) method and the robust standard error method of Driscoll and Kraay to account for heteroskedasticity, autocorrelation, potential serial correlations and cross-sectional dependence on panel data covering the period 1995-2022, we analyze these complex links. Our results indicate that human development has a positive effect on government revenues. In addition, we find that rising public debt is a brake on tax revenue mobilization. Finally, our analysis suggests that the negative effect of public debt on revenues could be moderated in the context of human development. Our results suggest that human development policies have a positive effect on the public finances. To reinforce this dynamic, we recommend increasing investment in education and health, which are essential pillars of human development. These investments should be accompanied by reforms aimed at optimizing the allocation of public resources in these sectors. The use of public debt can be an effective tool for stimulating economic growth and increasing public revenues in the context of well-developed human development.

Keywords: public debt; tax revenues; human development; PCSE method; WAEMU.

JEL classification: C5; F45; H2; H6; O15.

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1. INTRODUCTION

The International Monetary Fund (IMF) defines debt as all financial obligations contracted by one economic agent toward another, involving the payment of interest and/or repayment of the principal at one or more future dates (IMF, 2001). Public debt, on the other hand, represents all the loans contracted by the State and public administrations to finance their budget deficits. This amount fluctuates according to the repayments made and the new loans contracted to cover the state's financing needs. Developing countries, faced with the ambitious goal of achieving sustainable development goals (SDGs), need massive investments in infrastructure, human capital and climate resilience. However, their ability to mobilize sufficient public revenues or attract private investment is limited (Adeve and Karabou, 2022). This is why many states have turned to public debt as one of the main sources of financing for their economies. However, excessive public indebtedness can hamper public investment in sectors crucial to human development, such as education, health, sanitation and infrastructure. Therefore, resolving the problems faced by developing countries in achieving the SDGs requires a renewed global commitment, strengthened cooperation, and effective partnerships at all levels, as highlighted by SDG 17 "Partnerships for the Goals." The latter recognizes that achieving the 17 SDGs requires global collaboration and multi-stakeholder partnerships among governments, civil society, the private sector, international institutions, and other stakeholders.

West African Economic and Monetary Union (WAEMU) countries saw their indebtedness rise steadily, from 57.6% in 2022 to 59.5% in 2023, an increase of 1.9 percentage points linked to an increase in domestic debt (UEMOA., 2023). Total revenues and grants rose by 13.5% in 2022 to represent 18.0% of GDP in 2023, driven mainly by a 14.5% increase in tax revenues. The result is a tax burden rate of 14.5% in 2023, compared with 13.8% in 2022, which is well below the 20% target set by the Convergence, Stability, Growth and Solidarity Pact (CSGS). Despite an increase in tax revenues due in part to the implementation of tax reforms, none of the member countries has reached the 20% target. The average human development index for the WAEMU zone remains below that of sub-Saharan Africa, at 0.470 versus 0.5 in 2022.

In the literature, the relationship between public debt and tax revenues is complex and depends on many factors. While some, following the footsteps of Wagner (1893) or Ashinze and Onwioduokit (1996), see debt as a lever for stimulating growth and improving living conditions, others, such as Ricciuti (2003) and Huang *et al.* (2018), highlight the risks of excessive debt, which could compromise the sustainability of public finances and the well-being of populations. In the same vein, Amoh and Adom (2017) noted that public debt is a key determinant of tax revenues. Al-Qudair (2005) highlighted a long-term equilibrium between public debt and public revenues, suggesting a bidirectional causal relationship between these two variables in the short and long term, whereas Zaghdoudi (2018) noted that beyond a certain debt threshold, developing countries risk seeing their development compromised. These studies highlight the dynamic and often contradictory relationship between public debt and tax revenues. Human development could play a crucial role in this complex relationship between public debt and tax revenues. Indeed, human development acts as a lever for improving the public debt situation by stimulating economic growth, reducing public spending and strengthening the resilience of the economy. High human development leads to higher tax revenues and lower debt-related expenditures, thus contributing to greater sustainability of public finances. Empirically, Paweł (2023) reported that an increase in the share of spending on

education, health and social protection positively stimulates debt levels. In the same vein, Noga *et al.* (2018) reported a positive relationship between human development and public debt.

Understanding the role of human development in the relationship between public debt and tax revenues is therefore essential for designing effective public policies in the WAEMU zone. The aim of this study is therefore to analyze the role of human development as a mediating variable between public debt and tax revenues in WAEMU countries. This research is distinguished by several major contributions. The first is the analysis of the direct effects of public debt and human development on tax revenues. The second is the interaction variable between human development and public debt. The final element concerns the use of several econometric techniques, which guarantees the stability and robustness of the results.

The rest of the study is organized as follows: Section 2 presents the literature review, and Section 3 presents the methodology and data. The results and discussion are analyzed in Section 4. Section 5 presents conclusions and policy implications.

2. LITERATURE REVIEW

This section presents the theoretical and empirical literature on the relationship between public debt, tax revenues and human development.

2.1 Theoretical literature

The economic literature abounds with theoretical analyses of the role of public debt in development.

Among the proponents of moderate public debt is the famous Wagner (1893) law. According to this German economist, government spending tends to increase as the economy develops. This growth in public spending would be financed in part by borrowing, thus meeting society's growing needs in terms of infrastructure, public services and social protection. Industrialization and urbanization lead to a growing demand for complex and costly infrastructure, as well as an increased need for public services. As societies modernize, expectations of education, health and social services increase. These public goods and services, whose demand is income-elastic (Lybeck, 1988), require substantial investment. As a result, public debt can be seen as a necessary tool to finance these expenditures and stimulate economic growth.

In addition to Wagner's analysis, the Keynesian approach provides a theoretical benchmark for diagnosing consequences and legitimizing the budgetary courses of action adopted. The Keynesian view of the positive effects of public debt is that indebtedness in general is necessary because of the new investment opportunities it generates for economies. In the Keynesian debt model, aggregate demand and multiplier and gas pedal effects are fundamental characteristics. According to this school, an increase in public sector spending (public debt) can stimulate economic activity by increasing aggregate demand. Indeed, in a situation of underactivity, an increase in government spending financed by the capital market, thus increasing public debt, can have a stronger positive effect on economic growth even in the presence of tax burdens since it does not dampen aggregate demand. This is because the gas pedal effect of higher aggregate demand leads to increased private investment, which in turn increases output. A budget deficit can therefore be a factor in boosting economic activity and thus job creation for economies. In conclusion, the interventionist approach to budget deficits considers that state intervention, even though public borrowing, is necessary because

of the inability of liberal market norms to overcome cyclical crises, which can be disastrous for the future of economic activity. Financing economic activities by means of a budget deficit will have a positive effect on the level of development of states via improved consumer demand (Belmkaddem, 2019). These analytical frameworks demonstrate the positive correlation between public debt and economic development.

While some economists believe that public debt can stimulate investment and consumption, others warn of its perverse effects on economic activity. The theory of debt overhang, notably developed by Myers (1977), is a good illustration of this perspective. According to this theory, excessive public debt can crowd out private investment by increasing interest rates and reducing investor confidence. In other words, by borrowing heavily, the public sector can deprive the private sector of the financial resources it needs to develop.

This theory is supported by certain traditional growth models, which are inspired by classical and neoclassical methods. Unlike Keynesians, classics see no benefit to the economy from indebtedness (Ricardo, 1817; Barro, 1974). In some cases, indebtedness can have undesirable effects on future generations. Indeed, the various classical models assume that public borrowing can reduce the financial discipline of the budgetary process, thereby increasing the future tax burden. In other words, they equate indebtedness with a future tax that consumers must repay. For classics, a demand-driven fiscal policy is inefficient and only has inflationary effects on the economy. Economic agents see public borrowing as a form of tax deferred in time, which they will pay at a later date to repay these loans. Public debt constitutes a form of burden for future generations, as there is a transfer of the tax burden from the current generation to future generations (Ricciuti, 2003). According to classical theory, since the budget deficit based on public borrowing is equivalent to a tax burden, it has no effect on the level of production. Financing public spending through public debt will have no impact on economic activity, and even if it does, it could only be destabilizing (Belmkaddem, 2019).

In conclusion, while public debt can be a valuable tool for financing human development, high and unsustainable debt levels can severely undermine progress in health, education, and overall well-being. The interaction between human development and public debt depends on various factors, including the level of debt, how it is used, the quality of governance, and the overall economic context. Achieving a sustainable balance is crucial for developing countries to pursue both economic growth and improved human development outcomes.

2.2 Empirical literature

2.1.1 Public debt and tax revenues

The empirical literature devoted to the links between public debt and public revenues is vast. The following section summarizes some of the key works on this subject. Cassimon and Van Campenhout (2007) studied the fiscal response to public debt relief in 28 Heavily Indebted Poor Countries (HIPCs) over the period 1991-2004. Using a panel VAR model, they found that debt relief increased government revenues and encouraged growth in recurrent and development spending. On the basis of this finding, the authors conclude that the increase in public spending is due mainly to the increase in revenues resulting from public debt relief. Although taxation is generally accepted as a powerful strategic tool for assessing the macroeconomic impact of a country's fiscal policies, the measurement of tax revenues is often limited by methodological constraints. With this in mind, Andrejovská and Glova (2023)

studied the influence of public debt on total tax revenues by considering the tax competitiveness of the 28 EU member states. Their results suggest that public debt is a major determinant of tax revenues. Boukbech *et al.* (2018) explored the determinants of tax revenues in developing countries. After reviewing the main determinants discussed in the economic literature, two models are estimated in a panel including 29 lower-middle-income countries over the period 2001-2014. The results showed that public debt negatively affects tax revenues. Alawneh (2017) examined the impact of capital expenditures, current expenditures and internal and external public debt on taxes in Jordan from 2001-2014. The econometric analysis revealed a statistically significant and positive effect of both current and capital expenditures on taxes. The study also revealed a statistically significant and positive relationship between external and internal public debt on taxes in Jordan. Kiminyei (2019) also empirically investigated the relationships among Kenyan public debt, tax revenue and public expenditure. The study aimed to investigate the links between public debt, tax revenue and public expenditure from 1960-2011 via data obtained from economic surveys of the Kenya National Bureau of Statistics. A vector error correction model, forecast error variance decomposition and dynamic forecasting are employed. The results of the vector error correction model indicate that for the public debt and public expenditure equations, approximately 36% of deviations from long-term equilibrium are corrected in the following period, compared with approximately 8% for the tax revenue equation. The short-term model shows that the size of the public sector (public spending) has a debt-increasing effect, whereas the size of tax revenues has a debt-reducing effect. Furthermore, the results showed that public debt reacted positively to innovations in both tax revenues and public spending in the long term. Anastasiou *et al.* (2024) examined the existence and nature of causal relationships between tax revenue levels and a range of determinants using data from 26 European countries over the period 2015-2018. Specifically, by applying the panel cointegration method and estimating panel-based error-correction models, we explore the long-term and causal relationships between variables. The results of the analysis confirm the existence of cointegrating relationships between public debt and tax revenues.

2.2.2 Human development and tax revenues

Numerous empirical studies have examined the link between tax revenues and human development. The following section summarizes some of the key work on this subject. Taxation is an essential cog in the wheel of a modern economy. Governments are constantly striving to maximize their tax revenues to meet their financial obligations. Chettri *et al.* (2023) reported on South Asian countries between 2008 and 2017, showing that social factors play a decisive role in tax revenue levels. The authors show that life expectancy has a positive effect on tax revenues, whereas the infant mortality rate has a negative effect. These results underline the importance of investing in human capital to promote economic growth and strengthen the tax base. India's tax revenues are not sufficient to cover all public spending needs. To remedy this situation, it is essential to identify the levers for increasing these revenues. Garg *et al.* (2024) addressed this issue by analyzing the impact of various factors, both economic and institutional, on Indian tax revenues between 1991 and 2022. Their results revealed a positive link between the health status of the population and the government's fiscal effort. This correlation suggests that increased investment in the healthcare sector could help strengthen public finances. In Kenya, tax revenues have remained low for some time in relation to the

fiscal effort and policies in place, and the Kenyan government has always been on the lookout for an appropriate strategy to increase tax revenues and improve citizens' wellbeing. This has prompted researchers such as Singoro (2021) to examine the effect of the Human Development Index (HDI) on tax revenue performance in the country. The study employed secondary annual time series data for the period from 2003-2018 to estimate a linear model of tax revenue performance. Econometric estimates indicate that the human development index (HDI) is statistically significant and has a positive relationship with tax revenue performance. On the basis of these results, he concluded that Kenya's tax revenue performance is positively affected by the human development index.

2.2.3 Human development and public debt

Sustained growth in public debt has raised serious concerns about its potentially negative effects on the economy (Omrane *et al.*, 2015). Nevertheless, the economic literature also highlights the crucial role that moderate public debt can play in financing investment and stimulating growth. Indeed, several empirical studies suggest that an adequate level of debt can help attract capital, promote investment and improve the well-being of populations (Wang *et al.*, 2021). In local governments, debt is a key determinant of long-term solvency, financial stability and budgetary pressure. Debt in this sector can have repercussions on citizens' quality of life and business competitiveness. Paweł (2023) has thus studied the determinants of local government indebtedness in Europe while seeking to identify links between the debt burden and certain categories of expenditure. His analysis covers 27 European countries over the period 2007-2020. The results show that greater spending on education, health and social protection tends to increase debt levels. In their study, Mezni and Djebali (2022) analyzed the impact of IMF loans on the human development index (HDI) in Middle Eastern and North African (MENA) countries between 1990 and 2019. Using panel data, they showed that loans allocated to social sectors, such as health and education, had a significant positive effect on the HDI. In addition, their results revealed a positive correlation between the HDI and foreign direct investment, as well as trade openness. Conversely, loans to the domestic private sector appear to have a negative effect on the HDI. Zaghdoudi (2018) analyzed the nonlinear relationship between external debt and human development in a panel of 95 developing countries over the period 2002-2015. Using a smooth threshold regression model (PSTR), the author identified an optimal external debt threshold of 42%. Below this threshold, a one-percentage-point increase in external debt is associated with a 0.02% rise in the Human Development Index (HDI). Above this threshold, the effect is reversed, with a 0.01% decrease in the HDI for each additional percentage point of debt. These results suggest that external debt can stimulate human development when used judiciously but that excessive indebtedness can hinder economic growth and social well-being. The author therefore recommends prudent debt management, prioritizing investment in productive sectors and controlling population growth. More recently, Wang *et al.* (2021) examined the moderating role of public debt in the relationship between energy consumption and human development in BRICS countries (Brazil, Russia, India, China, and South Africa). Estimates reveal that public debt is detrimental to human development. Khan *et al.* (2025) examined the gap between public debt, globalization, and human development by considering the role of remittances and urbanization in the specific context of Pakistan. The study uses an advanced bounds testing approach of the autoregressive distributed lag (ARDL) model to assess the short-run and long-

run relationship between the selected variables, covering the period from 1990 to 2022. The results reveal a negative relationship between human development and public debt.

Empirical studies have extensively explored the bilateral links between public debt, tax revenues and human development. However, few studies have examined their complex interactions. Indeed, the relationships among debt, public revenues and human development are often complex. To draw robust conclusions and inform public policy, in-depth empirical analysis is needed. This study therefore sets out to explore these interactions empirically in the specific context of WAEMU countries.

3. METHODOLOGY AND DATA

3.1 Empirical specification

To study the impact of human development on the dynamics between public debt and tax revenues within the WAEMU, our analysis is based on the growth model proposed by (Lucas, 1988; Romer, 1989; Barro, 2001) and used by Afolabi and Raifu (2025) and Wirajing *et al.* (2023), as formalized in equation (1).

$$Y_{it} = A\,(K_{it})^{\alpha}(H_{it})^{1-\alpha} \tag{1}$$

The model indicates that improving technology (A), physical capital (K) and human capital stock (H) will improve a country's productivity (Y), which is important for increasing tax revenues. The linearized equation (1) gives:

$$logY_{it} = logA + \alpha logK_{it} + (1-\alpha)logH_{it} \tag{2}$$

Deriving the elements of equation (2) with respect to time, we obtain equation (3) as follows:

$$\frac{\dot{Y}_{it}}{Y_{it}} = \frac{\dot{A}_{it}}{A_{it}} + \alpha\frac{\dot{K}_{it}}{K_{it}} + (1-\alpha)\frac{\dot{H}_{it}}{H_{it}} \tag{3}$$

Equation (3) shows that the rate of productivity growth (which determines tax revenues) is influenced by growth in technology, human capital and physical capital.

We adjust this model to include public debt, human development and the interactive variable of the two variables, as well as control variables such as trade openness, private investment, urbanization, inflation, unemployment, institutional quality and foreign direct investment. By integrating these elements, the growth model becomes more complete and allows a more in-depth analysis of the determinants of economic growth, taking into account the complexity of the interactions between different factors. The resulting panel model is as follows:

$$\begin{aligned} TAXREV_t = {} & \alpha_0 + \alpha_1 HDI_t + \alpha_2 DEBT_t + \alpha_3 TRADE_t + \alpha_4 INV_t + \alpha_5 URBAN_t + \\ & \alpha_6 INF_t + \alpha_7 UN_t + \alpha_8 QINST_t + \alpha_9 FDI_t + u_{1t} \end{aligned} \tag{4}$$

The variable TAXREV represents tax revenues as a percentage of GDP, DEBT is external public debt as a percentage of GDP. The variable HDI indicates the human development index. TRADE represents trade openness, measured by the sum of imports and exports as a percentage of GDP. INV measures private investment as a percentage of GDP, UN refers to the unemployment rate, URBAN represents urbanization, measured by the evolution of the urban population growth rate, and INF is inflation. The variable QINST measures the overall index of institutional quality, which is calculated from the following indicators: (i) rule of law; (ii) citizen voice and accountability; (iii) regulatory quality; (iv) political stability and absence of violence; (v) control of corruption; and (vi) government effectiveness. FDI represents foreign direct investment, measured as capital inflows as a percentage of GDP, and u_t represents the error term.

To analyze whether simultaneous increases in human development and public debt are important for government revenues, this study incorporates an interactive human development and public debt term into equation (4), deriving empirical equation (5) with all model variables to be estimated as follows:

$$TAXREV_t = \alpha_0 + \alpha_1 HDI_t + \alpha_2 DEBT_t + \alpha_3 TRADE_t + \alpha_4 INV_t + \alpha_5 URBAN_t + \alpha_6 INF_t + \alpha_7 UN_t + \alpha_8 QINST_t + \alpha_9 FDI_t + \alpha_{10}(HDI * DEBT)_t + u_{1t} \quad (5)$$

Variables are presented in detail below.

3.2 Variables description

The variables of interest are presented first, followed by the model's various control variables.

– **Tax revenues:** This research uses tax revenues as a percentage of GDP. This refers to the share of a country's output that is collected by the state in the form of taxes. This variable is the dependent variable in our research. Tax revenues are used to finance public spending programs with the capacity to increase social welfare (Kiminyei, 2019).

– **Human development:** Human development is measured by the UNDP Human Development Index. Inspired by Amartya Sen's capability theory, the Human Development Index (HDI) was conceived by the United Nations Development Program (UNDP) in 1990 as an innovative tool for measuring human development. The HDI is a composite indicator that integrates three essential dimensions: (i) a long and healthy life, measured by life expectancy at birth; (ii) access to knowledge, assessed through indicators such as years of schooling and expected years of schooling; and (iii) a decent standard of living, reflected by gross national income per capita adjusted for purchasing power parity (PPP). By combining these dimensions, the HDI offers a more nuanced vision of human development, going beyond simple economic growth. Human development is a virtuous circle for public finances. By promoting economic growth, education, employment and formalization of the economy, it helps to broaden the tax base, improve tax compliance and increase the ability to pay taxes. A highly educated population has high-quality human resources, which increases production efficiency, enabling the government to increase tax revenues. Being well educated and well cared for makes people more aware of the benefits of paying taxes, as well as their responsibilities and obligations to the state. As a result, human development can have a

positive effect on tax revenues. When life expectancy increases, governments do indeed face pressure to adapt pension and social protection systems. However, it is not the increase in life expectancy itself that directly drives up tax revenues. In fact, this increase often puts a strain on public finances, sometimes necessitating reforms to pension systems and social transfers. The work of Castro and Camarillo (2014) and Svejnar (2002)deserves to be clarified with respect to the relationship they establish between human development measured by the under-fives mortality rate and tax revenues. The authors argued that developed countries tend to have a lower infant mortality rate, so we would expect a negative correlation between this variable and tax revenues. These results suggest a positive correlation between the level of human development and the level of government revenue.

– **Public debt:** Public debt is measured as the ratio of total gross public debt to gross domestic product (GDP) as a percentage. A country's debt level has a significant influence on its tax revenues. When a country is heavily indebted, particularly abroad, and its economic growth is insufficient to meet its commitments, governments are often forced to increase the tax burden to release the resources needed to repay the debt (Tanzi, 1977; Eltony, 2002). This tax increase can, however, have perverse effects. Excessive taxation can discourage investment, reduce economic activity and, ultimately, reduce tax revenues. Furthermore, high levels of public debt can lead to macroeconomic imbalance, resulting in increased trade deficits because import restrictions are often put in place to preserve foreign exchange reserves. These restrictions limit customs revenues and indirect taxes linked to imports, thus reducing overall tax revenues (Tanzi, 1992). Public debt is expected to have a negative effect on tax revenues.

– **Trade openness:** measured by the share of trade in gross domestic product (GDP). This is the sum of exports and imports of goods and services, measured as a percentage of GDP. Trade openness enables countries to specialize and benefit from large market shares. With this in mind, the relationships among trade openness, public debt and revenues will attract much more attention in both the theoretical and the empirical literature. Nagou *et al.* (2021) argue that trade openness is a driver of public debt accumulation. A positive sign is expected for the coefficient of the tax revenue variable.

– **Urbanization**: measured by the growth rate of the urban population. When well-managed, urbanization can be an important source of revenue for local and national governments. Indeed, the increase in urban land value, due to the growing demand for housing and commercial space, helps to increase property tax revenues. In addition, the concentration of economic activity in urban areas leads to an increase in individual and corporate income, which in turn broadens the income tax base. Chilima (2005) noted that the transition to urbanization is accompanied by a decline in the informal economy in favor of a more extensive formal sector. This structural transformation translates into higher tax revenues, as formal activities are generally more heavily taxed. A positive correlation is expected between urbanization and public revenues.

– **Foreign direct investment:** For the purposes of this research, foreign direct investment is defined as net investment inflows aimed at acquiring a lasting stake in the management of companies operating in WAEMU economies. Net investment inflows are measured as a percentage of GDP. The role of FDI as a composite stock of capital, knowledge and technology is to enable economic development (Popescu, 2014). Indeed, FDI reinforces the inadequacy of domestic funds in financing both changes in ownership and capital composition. FDI is also a major determinant of foreign capital inflows (Oche *et al.*, 2016). For these authors, foreign direct investment is vital for economic development, particularly

for developing countries that are known to have insufficient capital resources to meet the investment needs of the economy. Jenkins and Thomas (2002) saw FDI as a factor capable of providing foreign capital as well as attracting domestic investment. We anticipate a positive sign for the coefficient of the government revenue variable.

– **Inflation:** measured by the annual growth rate of the implicit GDP deflator, it indicates the rate of price change in the economy as a whole. The implicit GDP deflator is the ratio between GDP in the current local currency and GDP in a constant local currency. It is an indicator of macroeconomic stability, and when it is taken into account, we can see the effect of changes in the prices of all goods produced on economic performance. The relationship between inflation and economic performance has long been at the heart of decision-making. Accelerating inflation has been unanimously discouraged by all schools of economic thought because of its undesirable redistributive and welfare effects (Eggoh and Khan, 2014). Inflation is seen as part of a public finance problem, where high inflation rates are the result of an inefficient tax system (De Gregorio, 1993). A negative sign of the coefficient of the public revenue variable is expected.

– **Private investment:** Private investment is the main driver of long-term economic growth and strengthens market competitiveness (Sineviciene and Railiene, 2015). To this end, Abuselidze (2012) indicates that too high a tax burden can influence production technologies, the efficient use of resources and the productive capacity of economies. Vergara (2010) identifies two channels through which taxes affect private investment: on the one hand, higher taxes increase the cost of capital (cost of capital channel), and on the other hand, they reduce the internal funds available for investment (liquidity constraint channel). However, an increase in private investment can lead to an increase in government revenue. The expected sign is positive.

– **Institutional quality:** the global index of good governance indicates the complete index of governance quality. To avoid the problems of multicollinearity and bias associated with omitted variables, this research constructs a global composite index of the main indicators of institutional quality by employing principal component analysis (PCA), as was also done, on the one hand, by Bobbo (2018) and, on the other hand, by Langbein and Knack (2010) and Ouedraogo and Thiombiano (2025). PCA makes it possible to "summarize" a set of observed variables into a number of "components" that are linear combinations of these variables Ouédraogo (2020). Poor governance marked by rising levels of corruption can be detrimental to economic and social development. Corruption can have negative effects on the economy, notably on public debt through public spending. Indeed, corruption can lead to an increase in public spending. If a government finances its spending by increasing debt, in the case of corruption, a higher stock of debt is needed, leading to higher debt servicing costs. As such, corruption can not only increase the volume of public spending but also shift the composition of public spending away from vital sectors such as health and education (Mauro, 1998; Wei, 2001) toward more secretive and less transparent sectors such as defense (Cooray and Friedrich, 2013). A positive sign is therefore expected for the coefficient of the public revenue variable.

– **Unemployment:** In recent decades, most countries have suffered from high and persistent unemployment. As a result, the fight against unemployment is now at the top of the political agenda. It is now widely accepted in political debates that reducing unemployment rates requires less restrictive tax policies to stimulate employment (Koskela and Schob, 1999). Indeed, a reduction in taxes can increase employment (Bovenberg and Van der Ploeg, 1996), since a tax reform with a reduction in tax rates leads to a reduction in the burden on companies,

enabling them to recruit more and help combat unemployment. A negative relationship is expected between unemployment and government revenues.

3.3 Data

This research adopts a panel of seven WAEMU countries over the period 1995-2022 (Benin, Burkina Faso, Ivory Coast, Mali, Niger, Senegal and Togo). The empirical analysis is based on annual quantitative data and secondary sources from different databases, depending on the availability of variables. The data come mainly from the World Bank database (WDI., 2023) and the United Nations Development Program (UNDP, 2024). Figure no. 1 illustrates the joint evolution of public debt, tax revenues and human development in WAEMU countries between 1995 and 2022.

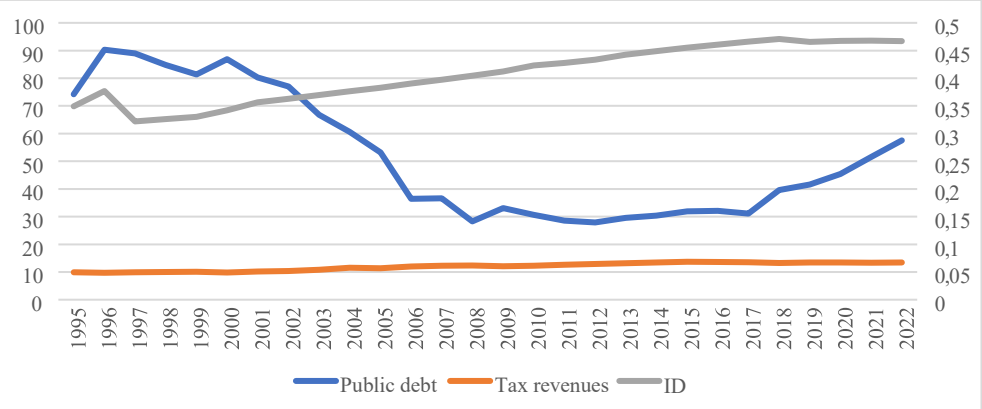

Figure no. 1 – Joint evolution of public debt, tax revenues and human development in the WAEMU from 1995-2022

4. RESULTS AND DISCUSSION

4.1 Results presentation

This section presents the results of the econometric tests and discusses the estimation method. The results of the multicollinearity tests are presented in Table no. 1. These tests are important for describing the degree of association between variables in the models. Multicollinearity analysis involves examining variance inflation factors (VIF). The VIF estimates the extent to which the variance of a coefficient is increased by its linear relationship with other predictors. It has been established in the literature that the deletion effect is a function of multicollinearity. Deletion of a variable should be allowed only if its variance inflation factor (VIF) is greater than 5 (Hair *et al.*, 2010; Akinwande *et al.*, 2015). However, the results presented in Table no. 1 indicate that the variance inflation factor (VIF) coefficients of the variables are all below 5, and the tolerance values (1/VIF) are all above 0.1, suggesting that our models would not suffer from multicollinearity problems.

With respect to the dependency tests, the results indicate that the variables are cross-sectionally dependent (Table no. 2). Stationarity tests are also performed. The results show that public revenue, trade openness, institutional quality, unemployment, urbanization and inflation are stationary at level. However, public debt, the human development index, foreign direct investment and private investment are stationary only in the first difference (Table no. 2).

In addition, the study uses Breusch and Pagan (1979) tests to check for heteroscedasticity. In addition, this research employs the Wooldridge (2010) test to examine possible error autocorrelation. The results of both tests reveal the existence of heteroscedasticity and autocorrelation in the models (see Annex for Tables no. A1 and no. A2). The null hypotheses that the error variances of our models are constant for all observations are therefore rejected. Given these results, estimating the models via the conventional ordinary least squares (OLS) strategy would provide inefficient results. Consequently, we estimate the tripartite relationship between public debt, tax revenues and human development using the panel-corrected standard error (PCSE) method. This technique effectively takes into account heteroscedasticity, autocorrelation and possible serial correlations Diendere and Yoda (2023). In addition, to increase the robustness of our results, we also estimate the models the robust standard error method of Driscoll and Kraay (1998). These two estimation techniques have been widely used in the literature (Ouedraogo *et al.*, 2025; Ouedraogo and Mano, 2025). The results of the two (02) estimators are presented in Tables no. 3 and no. 4.

Table no. 1 – Descriptive statistics

Variables	Obs	Mean	Std. dev	Min	Max	VIF	1/VIF
Tax revenues	196	11.955	2.634	4.954	20.30		
Public debt	196	49.019	29.616	11.176	160.830	2.07	0.483
Human development index	196	0.407	0.078	0.216	0.520	2.90	0.345
Trade openness	196	58.996	17.262	30.368	112.761	2.17	0.460
Foreign direct investment	196	1.616	2.583	-13.879	12.846	1.44	0.695
Private investments	196	13.847	5.155	2.612	33.066	1.77	0.564
Institutional quality	196	0.046	1.034	-2.726	2.290	1.16	0.861
Unemployment	196	4.087	2.926	0.273	11.710	1.57	0.638
Urbanization	196	4.216	0.893	2.721	6.725	1.64	0.608
Inflation	196	3.102	3.396	-7.594	16.286	1.09	0.914
Mean VIF						1.76	

Source: author

Table no. 2 – Tests for stationarity and variable dependence

Variables	CIPS	Hadri LM	LLC	Decision	CD-test	P-value
Public debt	-0.601	21.862***	-5.214**	I (1)	21.16	0.000
Human development index	-0.683	6.120***	-4.601***	I (1)	19.66	0.000
Tax revenues	0.059	14.690***	-3.619*	I (0)	18.95	0.000
Trade openness	-1.568	23.716***	-3.098	I (0)	12.11	0.000
Foreign direct investment	-2.914***	7.515***	-5.793***	I(I)	20.26	0.000
Private investments	-0.579	17.540***	-3.973*	I(I)	17.88	0.000
Institutional quality	-0.617	21.316***	-4.065	I (0)	16.21	0.000
Unemployment	0.215	23.769***	-3.770	I (0)	10.35	0.000
Urbanization	-4.642***	18.906***	-8.854***	I (0)	13.87	0.000
Inflation	-5.059***	0.840	-9.103***	I (0)	0.25	0.818

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Source: author

Table no. 3 – Public debt and tax revenues: the role of human development (PSCE)

Variables	Tax revenues		
	1	2	3
Trade openness	0.4894*	0.4760*	0.5690*
	(0.2814)	(0.2483)	(0.2909)
Private investment	2.5686***	2.4283***	2.3643***
	(0.4403)	(0.2880)	(0.5822)
Urbanization	1.4102***	4.7511*	1.5566***
	(0.4124)	(1.8644)	(0.6617)
Institutional quality	4.5428**	5.4152**	4.6471***
	(2.4321)	(1.9467)	(1.6617)
Unemployment	-1.1036*	-0.3706	-0.7562
	(0.5936)	(0.3894)	(0.8636)
Inflation	-0.1125	-0.2900	-0.0158
	(0.4908)	(0.6097)	(0.4584)
Foreign direct investment	2.3515**	2.3801***	1.8627**
	(0.8655)	(0.6413)	(0.7129)
Human development index	0.0150***		0.0192**
	(0.0070)		(0.0081)
Public debt		-0.3861***	-0.5531*
		(0.1029)	(0.0577)
Human development index*Public debt			0.7469**
			(0.0050)
Constant	18.5996***	12.3547***	15.6394***
	(3.9539)	(2.9554)	(3.2910)
R-squared	0.5087	0.4092	0.5199
Number of observations	196	196	196

Note: Standard error in parenthesis, *** significant at 1% level, ** significant at 5% level, and * significant at 10% level.

Source: author

Table no. 4 – Public debt and tax revenues: the role of human development (Driscoll-Kraay)

Variables	Tax revenues		
	1	2	3
Trade openness	0.4894*	0.4760*	0.5690*
	(0.1448)	(0.1551)	(0.1647)
Private investment	2.5686***	2.4283***	2.3643***
	(0.3576)	(0.3773)	(0.4136)
Urbanization	1.4102***	4.7511*	1.5566***
	(0.5505)	(1.5666)	(0.8564)
Institutional quality	4.5428**	5.4152**	4.6471***
	(1.2533)	(1.3182)	(1.1778)
Unemployment	-1.1036*	-0.3706	-0.7562
	(0.4931)	(0.7011)	(0.9577)
Inflation	-0.1125	-0.2900	-0.0158
	(0.5519)	(0.6524)	(0.5406)
Foreign direct investment	2.3515**	2.3801***	1.8627**
	(0.7576)	(0.6894)	(0.7424)
Human development index	0.0150***		0.0192**
	(0.0028)		(0.0091))

Variables	Tax revenues		
	1	2	3
Public debt		-0.3861***	-0.5531*
		(0.0929)	(0.0177)
Human development index*Public debt			0.7469**
			(0.0080)
Constant	18.5996***	12.3547***	15.6394***
	(2.8561)	(2.0013)	(4.9332)
R-squared	0.5087	0.4092	0.5199
Number of observations	196	196	196

Note: Standard error in parenthesis, *** significant at 1% level, ** significant at 5% level, and * significant at 10% level.

Source: author

4.2 Discussion

This subsection presents and discusses the main results of the econometric model estimates analyzing the relationships among public debt, tax revenues and human development in the WAEMU. As a reminder, the models are estimated using the panel-corrected standard error (PCSE) and robust standard error methods of Driscoll and Kraay (1998) to account for heteroskedasticity, autocorrelation, possible serial correlations and cross-sectional dependence. The results of these estimates are presented in Tables no. 3 and no. 4.

With respect to the variables of interest, we observe the following:

The influence of human development on tax revenues is positive and statistically significant. This indicates that an increase in the level of human development would lead to an increase in public resources in WAEMU countries. Indeed, by improving health, education and living standards, human development stimulates economic growth. This growth in turn leads to an increase in income, thus broadening the tax base. Moreover, the transition to a formal economy, encouraged by human development, means that more corporate and income taxes can be collected. Finally, a higher standard of living creates greater demand for public services, which in turn reinforces the acceptance of higher levels of taxation. In short, human development is a long-term investment that generates positive returns for public finances. By promoting economic growth, improving tax compliance and increasing demand for public goods, human development helps strengthen a country's tax base. These results are in line with the work of Singoro (2021). The author examined the effect of the human development index (HDI) on tax revenue performance. Econometric estimates indicate that the human development index (HDI) is statistically significant and has a positive influence on tax revenue performance in Kenya. From the same perspective, Ofoegbu *et al.* (2016) argued that an increase in tax resources would improve the human development index, which is a better measure of Nigeria's economic performance. Although our findings are similar to those of previous authors, they differ in several ways. Unlike previous authors who focus on small areas of individual countries, our analysis covers a broader area, which provides more conclusive results.

The results of our investigation within the WAEMU indicate that public debt exerts a significant negative influence on tax revenues. This observation suggests that a trajectory of increasing debt tends to contract tax revenues. Several dynamics underlie this relationship. Rising debt translates into increased financial burdens, reducing budgetary capacity for

productive spending such as public investment. Furthermore, the growing share of debt service in total spending limits the resources available to finance essential public services. Furthermore, the crowding-out effect induced by high debt can hamper private investment, slowing economic expansion and, ultimately, tax revenue generation. In conclusion, the persistence of excessive public debt constitutes a brake on tax revenues, perpetuating a cycle of constrained spending, high interest rates, and anemic growth. These findings support the work of Boukbech *et al.* (2018).

With respect to the effect of the interaction between public debt and human development, the results reveal that there is a positive and significant link between the variables, with a larger coefficient than the two variables taken separately. Our results show that the interaction term between public debt and human development increases public revenues in the WAEMU. The positive sign of the "public debt*human development" coefficient shows that the effects of public debt on public revenues can be enhanced by human development. Indeed, human capital is a valuable asset for a country seeking to control its public debt. By stimulating growth, reducing expenditures and strengthening the resilience of the economy, it helps to improve long-term debt sustainability. The improvement effect of public debt and human development on public revenues obtained by our study is not surprising, as it means that carefully managed debt, when invested in critical sectors such as infrastructure, healthcare and education, can significantly improve human development indicators and stimulate economic growth, thereby increasing the opportunities and well-being of the population. A high level of human development is generally associated with increased tax revenues, owing to a broader tax base and better tax compliance. This finding is consistent with those of Igudia (2021) and Opara *et al.* (2021) but contrasts with those of Sadiq *et al.* (2022) and Wang *et al.* (2021). Unlike these authors, our analysis innovated by introducing the interaction variable "public debt * human development" in order to study the effects of the simultaneous increase of these two variables on tax revenues. The introduction of the interaction variable "public debt * human development" allows for a more sophisticated and realistic analysis of the relationship between public debt and tax revenues, taking into account the crucial role of the human development context. This can lead to more precise conclusions and more appropriate policy recommendations.

For the control variables, we note the following:

Trade openness is positively correlated with tax revenues in WAEMU countries. While greater integration into international trade exposes economies to competitive pressures, it also promotes economic growth, a broader tax base and the formalization of businesses, thus contributing to higher government revenues. These findings are consistent with those of Baunsgaard and Keen (2010) and Profeta and Scabrosetti (2010). Similarly, a study by Amoh and Adom (2017) examined the effect of trade openness on commercial tax revenues in Ghana. The results show that trade openness has a positive effect on tax revenues in the international trade sector in the short term.

The results also show that the institutional quality indicator is positively correlated with tax revenues in the WAEMU region. A rise in institutional quality increases tax revenues. An increase in the quality of institutions is an essential lever for increasing public revenues. By building trust, improving the efficiency of tax administration and combating corruption, strong institutions help create an environment conducive to economic growth and the mobilization of public resources. Empirical studies show a positive correlation between democracy and tax revenues; when democratic freedoms and political rights are fully and

strongly expressed, tax revenues are greater (Dioda, 2012). In countries with high levels of democracy and freedom, taxpayers are more aware of government and tax regulations and are more willing to address tax issues. In other words, people will voluntarily pay their taxes and appear less likely to engage in tax evasion. In addition, political stability and social security create a better environment for the economy to function. As a result, tax revenues are higher (Castro and Camarillo, 2014).

The results of our analysis reveal a positive and statistically significant correlation between private investment and tax revenues. This means that an increase in domestic investment is associated with an increase in tax revenues. This relationship is explained by the fact that private investment stimulates economic growth, broadens the tax base and generates additional revenues for public administrations. Our results are in line with those of Kotarba and Kolomvcew (2014) and suggest that allocating private spending to development projects can help create an economic environment conducive to growth and higher public revenues.

FDI has a positive and significant effect on tax revenues. In other words, in WAEMU member countries, the higher the level of foreign direct investment is, the higher the level of government revenue. This could be explained by the fact that FDI gives rise to new businesses, often in high value-added sectors. These companies generate new taxable income (corporate income tax, personal income tax). FDI also contributes to growth in gross domestic product (GDP). As GDP increases, so do the tax bases (income, profits, consumption). The increase in income linked to economic growth leads to an increase in consumption, which in turn increases revenues from VATs and other indirect taxes. Finally, FDI can increase the economy's overall productivity, resulting in higher revenues and tax receipts. These findings corroborate Pratomo (2020) research, which asserts that increased FDI has a positive relationship with total tax revenues, as well as with corporate, personal and value-added taxes in developing countries.

Unemployment has a negative and significant coefficient with respect to tax revenues. An increase in the unemployment rate reduces public revenues in WAEMU countries. This is because unemployment leads to a decrease in household incomes, reducing the income tax base. In addition, the drop in demand linked to unemployment affects corporate profits, thus reducing the corporate tax base. Finally, during periods of unemployment, some individuals may be tempted to work in the informal economy, thus escaping taxation. In short, unemployment represents a real challenge for public finances. To limit its negative impact, it is essential to implement active employment policies, strengthen social protection and promote economic growth. As Tahlova and Banociova (2019); Andrejovská and Glova (2023) have shown, there is a negative correlation between the unemployment rate and tax revenues. These studies suggest that the decline in corporate profitability resulting from higher unemployment leads to a reduction in tax revenues, particularly corporate income taxes.

Urbanization has a positive and significant effect on tax revenues. Urbanization, i.e., the process of population concentration in cities, has far-reaching implications for the economy, particularly for public revenues. Indeed, urban growth generally leads to an increase in tax revenues for several reasons: (i) cities concentrate a large number of businesses, which considerably broadens the corporate tax base; (ii) wages are generally higher in urban areas, which translates into increased income tax revenues; (iii) the concentration of the population in cities stimulates consumption, thus increasing revenues from VAT and other indirect taxes; and (iv) cities are generally service centers (finance, trade, transport, etc.), which are sectors that generate substantial tax revenues. These results are in line with those of Chilima (2005), whose argument was that urbanization transforms the economy from informal to more formal, increasing

the amount of revenue collected as people become employed in more formal work. The results are also similar to those produced by an empirical study carried out by Karagoz (2013).

5. CONCLUSION AND POLICY IMPLICATIONS

5.1 Conclusion and policy recommendations

Empirical studies of the interdependence between public debt and tax revenues have produced contrasting results. The literature has gradually been enriched by analyses incorporating human development as an additional explanatory variable. In line with this trend, our study aims to deepen our understanding of the relationships among public debt, tax revenues and human development at WAEMU. By estimating the models using Driscoll and Kraay (1998) robust standard error methods and the panel-corrected standard error (PCSE) to account for heteroskedasticity, autocorrelation, possible serial correlations and cross-sectional dependence on panel data covering the period 1995-2022, we analyze these complex relationships within WAEMU countries.

Our results indicate that human development has a positive effect on public revenues. In addition, we find that the increase in public debt acts as a brake on tax revenue mobilization. Finally, our analysis suggests that the negative effect of public debt on revenues could be moderated in the context of human development within the WAEMU. Our results suggest that human development policies have a positive effect on the public finances of WAEMU member states. To reinforce this dynamic, we recommend increasing investment in education and health, which are essential pillars of human development. These investments should be accompanied by reforms aimed at optimizing the allocation of public resources in these sectors. The use of public debt can be an effective tool for stimulating economic growth and increasing public revenues in the context of well-developed human development. An adequate level of human development can reinforce the effectiveness of public debt as a tool for stimulating economic growth by enabling better absorption of public investment and promoting more inclusive growth.

5.2 Limitations and Future Recommendations

5.2.1 Limitations

This study, although it provides valuable information on the relationship between public debt, tax revenues and human development in WAEMU countries, has certain limitations:

- The Human Development Index (HDI), although a widely used composite measure, does not capture all dimensions of human development (inequalities, environmental sustainability). The study may be limited by the aggregate nature of this index.
- WAEMU countries exhibit significant differences in terms of economic structure, level of development, institutional quality, and fiscal policies. Treating these countries as a homogeneous group could mask dynamics specific to each nation.
- Findings based on WAEMU countries may not be directly generalizable to other regions or groups of countries due to their specific economic, institutional and social contexts.

5.2.2 Recommendations for Future Studies

Future studies could focus on the relationship between public debt, tax revenues and human development in individual WAEMU countries. Future research could also analyze the relationship between public debt and revenue by considering the role of other recently developed human well-being indicators, such as the Multidimensional Poverty Index (MPI), the Gender Inequality Index (GII), and the World Happiness Index, depending on available data.

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ANNEX

Table no. A1 – Wooldridge autocorrelation test H0: no first-order autocorrelation

Equations	Statistics F	Wooldridge probability	Decision
1ere equation	F (7, 139) = 64.15	Prob > F = 0.000***	Presence of autocorrelation
2eme equation	F (7, 139) = 73,32	Prob > F = 0.000**	Presence of autocorrelation
3th equation	F (7, 139) = 55,93	Prob > F = 0.000***	Presence of autocorrelation

Source: author. ***p < .01; **p < .05; *p < .1.

Table no. A2 –Breusch-Pagan/Cook-Weisberg test of heteroskedasticity

Ho: constant variance

Equations	Statistics F	Breusch–Pagan probabilities	Decision
1ere equation	Chi2(1) = 19,25	Prob > chi2 = 0.000***	Presence of heteroskedasticity
2eme equation	Chi2(1) = 15.74	Prob > chi2 = 0.000***	Presence of heteroskedasticity
3th equation	Chi2(1) = 13.93	Prob > chi2 = 0.000***	Presence of heteroskedasticity

Source: author. ***p < .01; **p < .05; *p < .1.