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Should We Restrict the Wage Bill to Tax Revenue ratio in West African Countries? Evidence from Côte d'Ivoire

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Abstract: *The objective of this study was to help a better understanding of the relationship between economic growth and the ratio of wage bill to tax revenue. After a brief review of both theoretical and empirical literature on arguments for or against the threshold set for this indicator, the authors used bounds tests in an ARDL setting to investigate the existence of long run dynamics among the variables. The data ranged from 1960 to 2015. The following findings were recorded: 1) the variables are cointegrated. Thus, there is a long-term relationship between the country's economic performance and the wage bill to tax revenue ratio; 2) there is an optimal threshold in the long run for the wage bill to tax revenue ratio which is* ***48.81%*** *for model 1 and* ***45.34%*** *for model 3. Beyond this threshold, any increase in this indicator would be detrimental to economic growth. This optimal thresholds are above the limit imposed by ECOWAS of* ***35%*** *which served as a convergence criterion. The study also found a minimum threshold below which the country's economic performance will be negatively impacted. This minimum threshold is* ***28.54%*** *for model 1 and* ***37%*** *for model 3. The wage bill to tax revenue ratio should be restricted but not at its actual imposed threshold.*

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I. Introduction

The establishment of the Economic Community of West African States (ECOWAS) in 1975 resulted from the growing desire of Heads of State and Government to promote economic, political, social and cultural cooperation and integration between the states of West Africa. From sixteen in its early days, ECOWAS currently has fifteen member states, namely - Benin, Burkina Faso, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo - after Mauritania left in 2000.

The desire for economic co-operation led Heads of State and Government to the adoption in 1987 of a Monetary Cooperation Program which was to pave the way to a single currency for the region. Mandated for the implementation of this program, the ECOWAS Commission is constantly monitoring a multilateral surveillance mechanism that describes the convergence criteria, adopted in 2001 (decision A / DEC / 17/12/01) and subsequently modified in 2012 by an Additional Act (Act A / SA.3 / 06/12).

The main assumption underlying this mechanism is that no significant regional integration can be achieved without the convergence of member countries' economic policies. Traditionally, macroeconomic convergence focused on the maximum acceptable thresholds for few key indicators that relate to fiscal discipline, monetary and financial stability. These indicators are normally used as eligibility criteria for membership in a regional economic grouping. In addition to the above reasons, macroeconomic convergence confers benefits to the Member States, individually or collectively. This includes achievement of macroeconomic stability i.e. sustainability of fiscal deficits, public debt, current account deficit low / stable levels of inflation, which are essential preconditions for strong and sustainable economic growth. These are some of the arguments put forthin establishing a set of criteria to guide economic policy in member states. In the case of the ECOWAS region, there were eleven such criteria including the ratio of wage bill to tax revenue.

Compliance with the convergence criteria is seen as an indication of good economic health. However, the performance of the Member States with regard to these indicators is rather mixed. Despite the ECOWAS Commission's efforts, Member States have not been able to comply with the established criteria in a sustainable manner. Indeed, no country has been able to comply with all the criteria in a given year. Even when some criteria are satisfied, it is not done on a regular basis, thus indicating some form of inherent macroeconomic instability in a given country.

It was in light of the above that the 45th Ordinary Session of the ECOWAS Heads of State Summit endorsed what was called the "rationalization" of the macroeconomic convergence criteria. This rationalization exercise, consisted in reducing the number of criteria from eleven (11) to six (6), including the elimination of criteria related to domestic resources mobilization (ECOWAS 2016):

- Tax Revenue to GDP ratio ≥ 20 %;

- Wage bill to Tax Revenue ratio ≤ 35%;
- Public Investments (financed locally) to Tax Revenue ratio ≥ 20%.

This rationalization, or rather the elimination of some indicators, in particular, the Wage Bill to Tax Revenue ratio, was not the result of an empirical study. One of the main arguments put forth is the fact that many Member States could not comply with them. This decision was partly due to the fact that the root causes of non-compliance with these criteria are still poorly understood. To our knowledge, no studyhas been done to explain thisin the case of the ECOWAS economies, in particular, the reasons for non-compliance with the Wage Bill to Tax Revenue ratio criterion and therefore its relationship with economic growth.

It should also be noted that among the retained six convergence criteria, two of the primary criteria were slightly relaxed from their initial levels. Thus, the maximum average annual inflation rate is set at 10% and the initial threshold of 5% becomes a medium-term objective to be achieved by 2019. The criterion on external reserves in months of imports isreduced to three months instead of six months. This study, which focuses on Côte d'Ivoire, seeks to better understand the reasons for non-compliance with the Wage Bill to Tax Revenue ratio threshold by analyzing how it relates to the country's economic performance. The paper is organized as follows: Section 2 presents a historical analysis of the Wage Bill to Tax Revenue ratio; Section 3 reviews the theoretical and empirical arguments on the relevance of monitoring the Wage Bill to Tax Revenue ratio; Section 4 presents the data and explains the method analysis; Section 5 discusses the empirical results and Section 6 concludes the study and makes some recommendations.

II. Historical analysis of the wage bill to tax revenue ratio

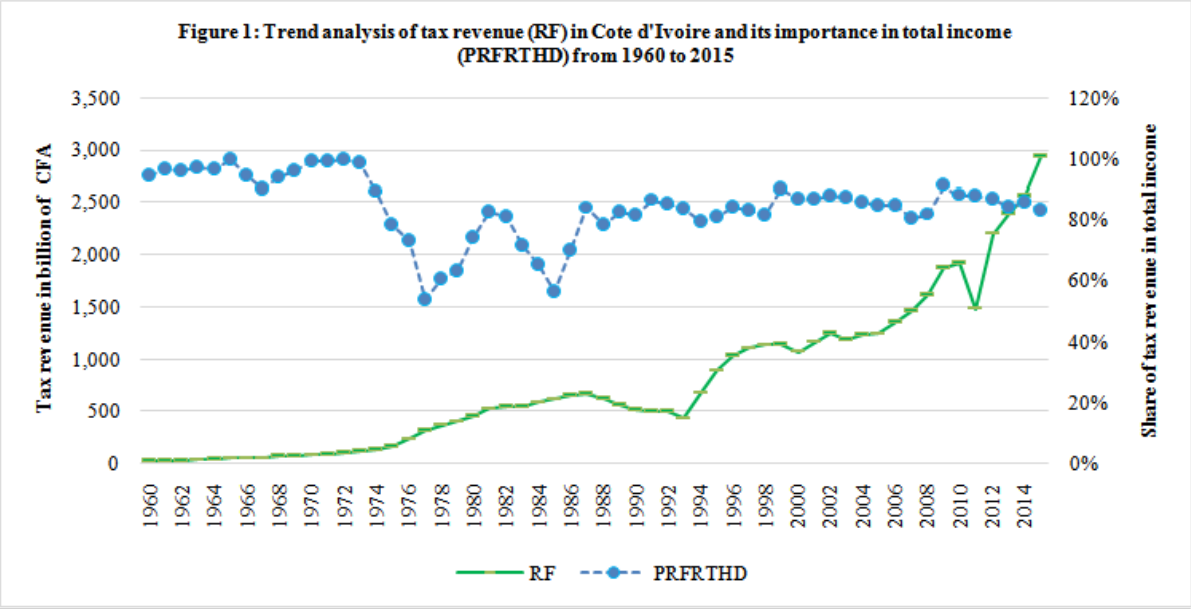
To overcome the challenges of development and satisfy citizens'expectations, a country needs a critical mass of resources that could come from at least two sources: internal and external. However, relying on external sources to finance development usually leads to a situation of dependency and creates a vicious circle of indebtedness that countries can hardly extract themselves from. In fact, a country relying heavily on external resources is not only exposed to external shocks but also loses the opportunity to own its development plan, which in this case is dictated by its donors. Whereas relying on internal resources, decision-makers are less subject to contingencies of resources and have some autonomy of planning, maneuverable at will, to improve the well-being of their population.

In recent years, many voices have risen and call developing countries in general, to break away from the dependence on developed countries by relying more on domestic resources (N'Zué et al, 2012). Improvement in domestic resource mobilization and its management, in particular, tax revenues, is thus, an economic governance requirement. How are these domestic resources in Côte d'Ivoire? As shown in Figure 1, Côte d'Ivoire's tax revenues have been on an upward trend since independence. From about 24 billion CFA francs in 1960 representing 95% of the total income of the government, tax revenues rose steadily, reaching 670 billion CFA francs in 1987, before declining until 1993 to 435 billion CFA francs.

The economic crisis in the country since the second half of the 1980s could explain this reversal of trend. This is the period of contraction of economic activitieswith the implementation, with no real success, of the Structural Adjustment Programs (SAP). From 1994, probably due to the devaluation of the CFA franc (January 1994) and economic recovery efforts, the country's tax revenues showed an upward trend except in 2011 with the post-election crisis, the culmination of the political conflict that had been going on in the country since 2002. Thus, from CFAF 1,490 billion in 2011, tax revenues rose sharply to CFAF 2,940 billion in 2015, representing an increase of almost 97% over four years.

How did this trend of tax revenues affect total revenues? The answer to this question sheds light on the fact that the relative share of tax revenue in total revenue, which averaged 85% between 1960 and 2015, masked significant disparities over time. In fact, during the first decade after independence, most of the country's resources came from tax revenues, with an average share of 98%, with peaks of 100% in 1965, 1970 and also in 1972. This result was attributable to improved performance of the agriculture sector, making these years the prosperous period of the countrystigmatized as the "Ivorian Miracle". However, the share of Tax Revenues in Total Revenues varied quite a lot in line with the economic conditions, particularly the trend in the export sector. This share, which fell sharply over the 1973 - 1977 period to 54%, its lowest level in the period under review, was due to the oil price shocks and the reversal of the positive trend in the cocoa-cocoa market. This period marked the beginning of a long and widespread economic crisis that did not spare Côte d'Ivoire with its consequences of underemployment, unemployment, and inflation. The economic recovery measures implemented, in particular the SAPs of the early 1980s, with the view to promoting the consolidation of public finances, did not always produce the expected results. The mobilization of tax revenues was relatively less important and the relative share of Tax Revenue to total revenue reaching only 57% in 1985. However, the pursuit of fiscal consolidation efforts over the years 2000, especially with the increase in non-tariff tax revenues, helped to keep the share of tax revenue in total revenue above 70% since the second half of the 1980s and to

even reach a peak of 92% in 2009. The size and quality of tax revenues are better understood when they are paralleled with the total expenditures.



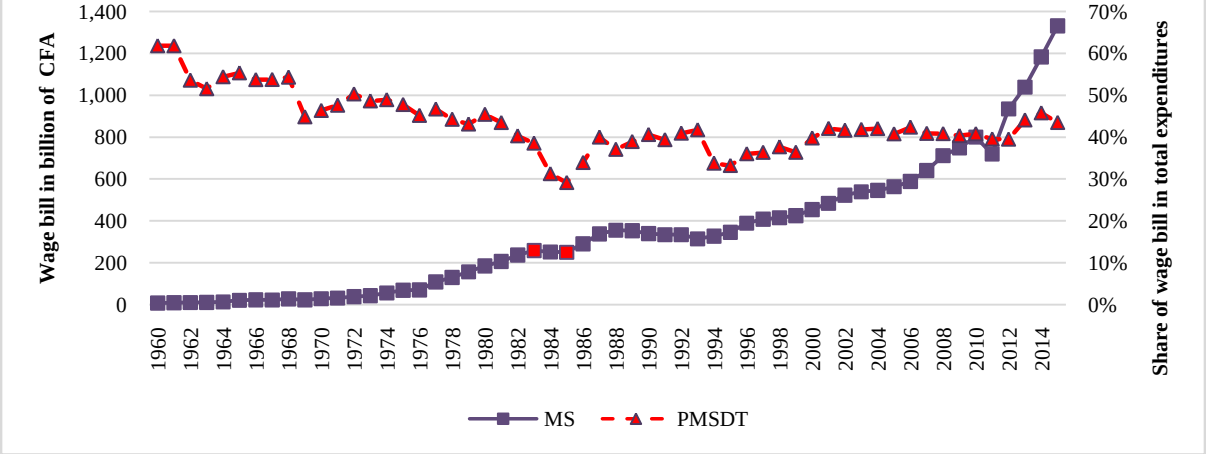
Source : Author with data from BCEAO

Thus, in addition to trend analysis done on tax revenue together with total revenues, the dynamics of the wage bill and its share in total expenditures are shown in Figure 2. The country's wage bill has been growing steadily since 1960 in relation to the increase in the number of public employees. Only few episodes of slight declines are observed in 55 years. The first episode of decline ranged from 1983 to 1985. We observe a fall in the wage bill from 258 billion CFA francs in 1983 to 252 billion CFA francs in 1984 and 251 billion CFA francs in 1985, representing a 2.7% decline in three years. This decline in the wage bill was undoubtedly attributable to the fiscal consolidation measures implemented. Indeed, in 1983 the country acceded to its third World Bank structural adjustment loan to support the Macroeconomic Stabilization and Adjustment Program launched in 1981. The main reform of this program was to reduce public investment to adjust domestic demand and to restructure parastatals (Nshimyumuremyi, 1997). In 1984, the government decided to align the salaries of parastatals with those of the ordinary civil servant. The alignment decision amounted to a two-thirds reduction in the wages of workers in these parastatals.

The second episode of decline covered the period 1988-1993. It was marked by a fall in the wage bill from CFA franc 356 billion in 1988 to CFA franc 314 billion in 1993. The persistence of economic hardship despite the reforms implemented at the beginning of the 1980s and those adopted from 1988 until the first half of the 90s, could explain the decline in the country's wage bill. The last episode of a decline in the wage bill was the year of the post-electoral crisis. In 2011 the wage bill dropped to 720 billion CFA franc against 800 billion in 2010.

Moreover, the share of the wage bill in total expenditure has been decreasing throughout the entire period of analysis (1960-2015). It reached its lowest level in 1985 at 29%. Over the past fifteen years, it has remained stable at around 40%, compared to an average of 43% over the 55 years of analysis.

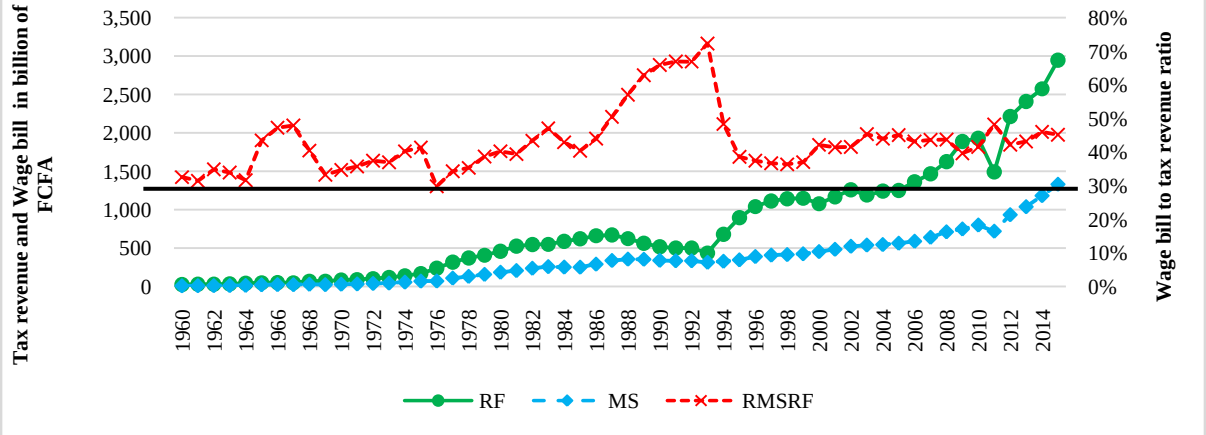
Figure 2: Trend analysis of the wage bill (MS) in Cote d'Ivoire and its importance in total expenditures (PMSDT) from 1960 to 2015



Source : Author with data from BCEAO

The above trend analysis of the two components of the wage bill to tax revenue ratio allows, to some extent, to understand the dynamics of this indicator. One of the main features of this ratio in the case of Côte d'Ivoire is that it has been constantly above the threshold of 35% from 1960 to 2015. It averaged 43% and even reached a peak of 72% in 1993, the year before the devaluation of the CFA franc, before falling to 48% in 1994, to 39% in 1995 and stabilizing around 37% between 1996 and 1999.

Figure 3: Trend analysis of tax revenues, wage bill and the wage bill to tax revenu ratio from 1960 to 2015



Source : Author with data from BCEAO

III. Brief review of theoretical and empirical literature

In general, the wage bill is the largest component of Government's consumption expenditures. It is about 60% for most OECD countries (Fernandez de Córdoba et al, 2009) and at least as much for African countries (in some cases around 80% (Ouédraogo, 1999)). As a result, budgeting and monitoring it have important social and economic implications. The challenges facing countries, particularly in terms of worsening public deficits and debt accumulation, have made public wage policy a topic of great interest, widely discussed in the literature. However, although the issue is not explicitly addressed in terms of targeting a critical threshold for wage bill to tax revenue ratio as envisaged in this study, the underlying idea in most studies is the same i.e. set rules that guide the annual growth of the public sector wage bill. As pointed out by Gomes (2014), the trend of average wage bill of a country must be in line with that of an aggregate indicator of the economy, such as GDP per worker or the average wage bill of the private sector.

Whether analyzed in absolute or relative terms, various analysis suggest that the size of government civil service and the trend of Government payroll should be in harmony. This requirement led many countries, particularly in Africa, to reform their public wage policy. Notwithstanding the type of these reforms, all have in

common one main objective i.e. reduce the weight of the public sector wage bill in national budgets and thus in the GDP (Gomes, 2014). The wage bill of most Sub-Saharan African countries is higher in relative terms, averaging 7% of GDP. It is around 4% in other developing countries of Asia and Latin America (Fedelino et al., 2006). Most reforms of wage bill in Sub-Saharan Africa began in 1993 and focused on the CFA franc countries. The wage bill to tax revenue ratio thus declined significantly, from more than 90% in the early 1990s to 32% in 2007 before reaching 37% in 2013 (ADB, 2015). It is worth noting that before the early 1990s, other countries such as The Gambia, Madagascar, Mozambique, Sierra Leone, Tanzania, and Uganda had reduced their average wage bill by more than one (1) percentage point GDP (Lienert, 1998).

One of the most radical and controversial adjustment measures was the setting of an upper threshold for public wage bill (relative to GDP or domestic resources) adopted by some countries, or regional organizations. These ceilings have been widely used in IMF programs for low-income countries to contain growth in government spending (IMF, 2007a, 2007b, 2009, Verhoeven and Segura, 2007). About 40% of the Poverty Reduction and Growth Facility (PRGF) programs included quantitative conditionality on countries' wage bill. This conditionality was mainly African. Between 2003-2005, out of the 24 PRGFs for Africa, fourteen (14) included wage bill conditionality with even performance control criteria in four (4) countries (Ghana, Kenya, Malawi and Chad) and quantitative references in nine (9) cases (Benin, Burkina Faso, Burundi, Mali, Mozambique, Niger, Senegal, Sierra Leone, and Zambia). In other regions of the world (Asia, Europe, Middle East and Central Asia), totaling fourteen (14) PRGFs, performance criteria such as these were not used (Fedelino et al., 2006).

Are these reforms relevant or inappropriate? There is no systematic answer to this question in the literature and the practical difficulties encountered by many countries in respect of this self-discipline budgetary policy,revealed the complex nature of the issue. While there seems to be a broad consensus that public wage policy must be consistent with some level of efficiency and productivity, the optimal level of Government's wage bill remains controversial. This controversy stems from the fact that payroll policy of a country contains a consubstantial ambiguity i.e. it could be, on one hand, a source of macroeconomic imbalance and on the other hand a necessary condition for socioeconomic development. This ambivalence continues to fuel the debate on the optimal level of the public wage bill.

Although amplified since the debt crisis of the years 1980-1990, and more recently since the beginning of the global financial crisis of 2008, with additional pressures on countries' budgets, the debate on the control of public wage bill results from neoclassical theory. In a neoclassical environment, an increase in the public wage bill (in terms of employment and wages) has a crowding-out effect on private sector employment (Finn, 1998, Cavallo, 2005). This eviction occurs because there is more job security in the public sector and more so when public wages are higher. Thus, an individual is more likely to seek or wait for a job in the public sector rather than to seek or accept employment in the private sector (Feldmann, 2009a, 2009b). Several empirical works corroborate this theory. Alesina et al. (2002) found a significant negative effect of public spending (wage bill), on private sector profits and investment. In addition, it is found that public wage bill inhibits private sector employment in OECD and Middle East countries. This crowding out effect is large enough to increase unemployment in a number of developed countries (World Bank, 2012, IMF, 2012).

In conjunction with the crowding out effect, recent empirical work suggests that the government's real wage expenditures are subject to a pro-cyclical bias, that is, they move in the same direction as the economic cycle. Thus, the wage bill reinforces fluctuations in economic activity (Galí and Perotti, 2003, Turrini 2008, Beetsma and others, Holm-Hadulla et al., 2010). From these studies, it appears that government wage bill can have negative repercussions on the budgetary and economic performances. In particular, it could lead to loss of competitiveness for the private sector given the interaction between public and private sector employment and wages.

With the debt crisis and fiscal management imperatives, the monitoring of government wage bill goes beyond the economic dimension to add a social and political dimensions. The need to reduce fiscal deficits, stabilize rising levels of public debt and put in place effective fiscal adjustment strategies goes beyond academic thoughts. In this respect, fiscal consolidation measures are strongly advocated. Since the work of Giavazzi and Pagano (1990), as well as Alesina and Perotti (1995), a large empirical literature has studied the effects of fiscal consolidation. According to these authors, reductions in the public wage bill should play a key role in fiscal consolidation programs (Alesina and Perotti 1996, Alesina and Ardagna 2010). Using a panel of OECD countries over the period 1980-2007 and the Bayesian Model Averaging (BMA), Hernandez de Cos and Moral-Benito (2014) showed that a reduction in government wage bill is the most robust determinant of fiscal consolidation.

However, the theoretical predictions and the empirical evidence mentioned above, in favor of a limitation, or even a reduction of the public wage bill, remain highly controversial in the economic literature. The Neoclassical - Neokeynesian dichotomy, relating to the impact of public spending, contributes to fueling this controversy. This is basically due to the fact that the mechanisms of transmission of structural disturbances

of the wage bill to the economy are not completely controlled. In other words, there is no clear answer to how the economy responds to budget shocks in general and specifically to expenditures on employees (Perotti 2007, Pappa 2009). By studying, in the case of the United States, the transmission of fiscal shocks to the labor market using a structural VAR model, Pappa, (2009) showed that the response to a rise in public employment is mixed. Indeed, the rise in public employment led to an increase in real wages and total employment in most US states with the exception of one-third of them, where total employment declines. Many other studies provided results that are contrary to neoclassical predictions. Thus, Blanchard and Perotti (2002) and Perotti (2004) showed that production, real wages and private consumption are positively linked to government spending, especially spending on government employees, which reinforces the Keynesian paradigm.

Moreover, although a consensus seems to be established around the need for fiscal adjustment in the event of a deterioration of the public deficit and accumulation of debt, the issue related to the extent to which the reduction of public wage bill contributes to the success of fiscal consolidation is far from settled. Indeed, there are studies that showed the limits of the empirical literature justifying this positive relationship. For example, Buyse and Heylen (2014) do not support the importance of this impact, especially when the costs for realloting the workforce are high. Using a dynamic general equilibrium model with overlapping generations, these authors showed that, although the reduction in public spending, especially in terms of personnel, is better than the rise in taxes on labor and capital, the positive impact of this reduction on GDP is limited and more so when it comes to apprehending it in terms of well-being. Perotti (2011) showed that there is even a drop in production in the short term as a result of a reduction in public expenditures on personnel. The studies by Heylen and Everaert (2000), Tagkalakis (2009) and Larch and Turrini (2011) do not suggest a successful fiscal consolidation when the measure is mainly based on the reduction of government's wage bill. Heylen et al. (2013) found a positive impact on fiscal consolidation only when the efficiency of the public sector is weak.

One of the strongest arguments against restrictive measures on public wage billi.e putting an upper bound on wage bill to tax revenue ratio, is that these measures impose unacceptable constraints on essential social spending (Modi and Davis, 1997, Fedelino, Schwartz and Verhoeven, 2006). In other words, the setting of an upper bound on public sector wage bill is seen as a measure that prevent low-income countries from developing employment in key sectors such as health and education. Indeed, with the acute need for more qualified personnel, especially for sub-Saharan African countries, this threshold constitutes a major obstacle to the implementation of social policies in basic service sectors i.e. health and education (Chen and al., 2004, World Bank and IMF, 2005). Most estimates point to a large public employment gap in sub-Saharan Africa. For example, estimates by Berg and Qureshi (2005) suggested that achieving the MDGs required a tripling of the workforce in the health sector, i.e. the addition of more than one million workers, something no country has been able to do. Moreover, the need for more and better-qualified workers should be accompanied by good incentives to work effectively, including financial incentives. In other words, the social and economic development of Africa inevitably involves an increase in the public wage bill.

But up to what acceptable level both economically and politically, should this increase be done? It also raises the question how the setting of an upper threshold for government's wage bill impacts economic performance? The relevance of this question contrasts with the lack of in-depth studies of the impact of public employment in developing countries (Behar and Mok, 2013). The attempt to answer these questions, in the particular case of Côte d'Ivoire, is undoubtedly an important contribution to the debate. It fills a void in the vast empirical literature on the quantitative and qualitative assessment of the impact of the wage bill to tax revenue ratio on economic growth.

IV. Material And Methods The data

Data on the Ivorian economy are obtained from annual series ranging from 1960 to 2015. The sources include the Central Bank of West African States (BCEAO) and the World Development Indicators of the World Bank. All the data gathered provide information on the economic and financial structure of the country. The data include real per capita Gross Domestic Product (GDP), employment (obtained from PennWorld Table), Gross Fixed Capital Formation (GFCF, a proxy for investment) and consumer price index as a measure of inflation. Government's tables on financial operations provide data on Government's income and expenditure, including tax revenues and the public wage bill. Data on international trade (exports and imports of goods and services) are also available from the above sources.

4.2. Method of analysis

Before addressing the methodological issues, it is important to underline again the idea behind the policy of setting an upper bound for public wage bill to tax revenue ratio. The first assumption is that it would have a positive effect on economic growth when it is relatively low, whereas this relationship could be reversed in the case where it is quite high. This raises the issue of the possibility of a non-linear effects of the wage bill to tax revenue ratio on economic growth. To our knowledge, there are hardly no contribution that interrogates the

existence of a non-linear effect of the wage bill to tax revenues ratio on economic growth. Most studies, in relation to public finances, deal with the non-linear effects of the budget deficit or the ratio of public debt on economic growth (Blanchard 1990, Giavazzi and Pagano 1990, Bertola and Drazen 1993, Sutherland 1997). This type of non-linear effect can be investigated via threshold models as introduced by Tong and Lim in 1980 (see also Tong, 1990) and developed by Tsay (1989) and Hansen (1996) or simply by a quadratic model. It is the latter that we will use following Patillo et al. (2011) because of itssimplicity.

4.2.1. Correlation between wage bill and economic growth

A number of key variables are often used in the theoretical and empirical characterization of economic growth. In general, studies use technical progress and the accumulation of physical as well as human capital as the main determinants of long-term economic growth. The accumulation of physical capital is represented by the share of total investment (proxied by GFCF) in GDP. The stock of human capital is determined by the level of employment. In addition to these two determinants, others factors are often examined in the context of macroeconomic policy. These include the rate of inflation, which indicates the benefits of minimizing the volatility of consumer prices, as well as the impact of budget deficits often stemming from a large public sector (due to high public spending, in particular the wage bill). Finally, international trade can be endogenous to the growth process. The openness of the country to trade and the terms of trade would tend to show that trade follows the patterns of growth.

4.2.2. The model

We use a standard growth model as in the literature and introduce public wage bill to tax revenue ratio variable in linear and quadratic term (our variable of interest) to investigate the existence of an optimal wage bill to tax revenue ratio.

The general form of the model is as follows

$$\Delta \ln pibh_t = \alpha + \beta \ln pibh_{t-1} + \theta_1 \ln emp_t + \theta_2 \ln inv_t + \theta_3 \ln ipc_t + \theta_4 solde_t + \theta_5 \ln tde_t + \ln (export + import) + \varepsilon_t \quad (1)$$

With : $\Delta \ln pibh_t$ logarithm of real GDP per capita; $\ln emp_t$: logarithm of employment; $\ln inv_t$: logarithm of GFCF as a percentage of GDP; $\ln ipc_t$: logarithm of consumer price index as a proxy for inflation ; $solde_t$: fiscal balance as percentage of GDP ; ε_t : random disturbances.

Equation (1) is a relatively general specification used in several studies on growth in the economic literature (see Alberto and Perotti (1994) for a review of these models). The standard variables used in the estimation of a growth function serve as control variables, in addition to our variable of interest i.e. wage bill to tax revenue ratio.

Thus, lagged real GDP per capita, $pibh_{t-1}$, should have a negative and significant coefficient to ensure the convergence of the model to the steady state. For the investment variable, inv_ta positive coefficient is expected to reflect the impact of physical capital in the production process. Employment, emp_t, could be ambiguous depending on how actual labor impacts economic performance. The consumer price index, ipc_t, captures the effect of rising inflation on growth. This effect may be positive or negative. The terms of trade, tde_t variable is introduced into the model to capture the effects of external shocks. The expected sign of its coefficient is positive. The indicator of trade openness, which is the sum of exports and imports in relation to GDP (ouv_t) , is expected to be positive resulting from economies of scale, exposure to competition and taking advantage of available knowledge and technology. Finally, the fiscal balance variable is used to capture the impact of fiscal policy on GDP. An improvement in the fiscal balance would have a positive effect on economic growth, while a deterioration would have a negative impact. However, this variable is only implicit in the model estimated for this study. It was transformed so as to bring out our variable of interest, i.e. wage bill to tax revenue ratio $(ms_t = MS_t/RF_t)$.

The use of the variable (ms_t)therefore results from the transformation of the following identity of the fiscal balance:

$$SOLDE_t = (RF_t + AUR_t) - (MS_t + AUD_t)$$
$$= (RF_t - MS_t) - (AUR_t + AUD_t)$$
$$= (1 - MS_t/RF_t) * RF_t - AUSOLDE_t \quad (2)$$

With AUR_t and AUD_t represent other current revenues and other current expenditures. $AUSOLDE_t$is the balance of other current revenues and other current expenditures.

As a proportion of GDP, Equation (2) becomes:

$$Solde_t = (1 - ms_t/rf_t) * rf_t - Ausolde_t \quad (3)$$

Since $ms_t < 1$, $log[(1 - ms_t) * rf_t] \approx -ms_t + log(rf_t)$using linearization in the neighborhood of zero. In view of this decomposition, the exogenous variables used are $ms_t, log(rf_t) et Ausolde_t$, in place of the variable SOLDE and the square of the Wage Bill to tax revenue ratio, ms_t^2. Thus, the transformation of equation (1)

gives the quadratic function below which is based on the assumption that the effect of the wage bill ratio on real GDP per capita changes sign after a threshold.

$$\Delta\ln pibh_t = \alpha + \beta\ln pibh_{t-1} + \theta_1\ln emp_t + \theta_2\ln inv_t + \theta_3\ln ipc_t + \theta_5 Ausolde_t + \theta_6\ln(rf_t) - (\theta_7 ms_t + \theta_8 ms_t^2) + \theta_9\ln tde_t + \theta_{10}\ln ouv_t + \varepsilon_t \quad (4)$$

Equation (4) indicates that the coefficient of the wage bill to tax revenue ratio ms_t is expected with a positive sign and the quadratic term, ms_t^2 should have a negative sign. Thus, at low wage bill to tax revenue ratio, an increase in employment and / or public wage could have a positive effect on economic growth. However, when the wage bill is high, its impact on economic growth could be negative. Thus the relationship between the wage bill on tax revenues and the economic growth of Cote d'Ivoire could be non-linear. If that is the case, we could determine a break point such that, when wage bill to tax revenue ratio is less than or equal to that threshold ($ms_t \leq ms^*$) it has a positive effect on GDP growth. Beyond the threshold, the effect becomes negative. The optimum point, ms^* is the level of wage bill to tax revenue ratio that would maximize the growth of real per capita income. We take the first derivative of $\Delta\ln pibh_t$ with respect to the wage bill to tax revenue ratio in equation (4) above. We obtain:

$$\frac{\delta(\Delta\ln pibh_t)}{\delta(ms_t)} = -(\theta_7 + 2\theta_8 ms_t)$$

At the optimum, we set, $\frac{\delta(\Delta\ln pib\,h_t)}{\delta(ms_t)} = 0$, and solve for ms^*.

$ms^* = \frac{-\theta_7}{2\theta_8}$. This threshold will be tested to see whether it is significant or not.

4.2.3. Time series characteristics of the data

Given the time series nature of the data, it is important to analyze its characteristics. This is done by determining whether the series are stationary or not and also assess the existence of long-term dynamics between the country's growth performance and the wage bill to tax revenue ratio. Stationarity will be assessed via unit root tests i.e. Dickey-Fuller (ADF) and Philip Perron (PP) tests. We will then investigate the long run dynamics between economic growth and the wage bill to tax revenues ratio using the Autoregressive Distributed Lag approach (ARDL). This approach leads us to reformulate our model (equation 4) to bring out both short and long-term dynamics. The general formulation of the ARDL model is presented in the following form

$$Y_t = \alpha \quad + \sum_{i=1}^{p} \delta_i Y_{t-i} + \sum_{i=0}^{q} \beta'_i X_{t-i} + \varepsilon_{jt} \quad (5)$$

Where Y_t is the dependent variable and X_t represents the explanatory variables that can be stationary at i.e. *I(0)* or stationary at the first difference i.e. *I(1)* . α is the constant term, δ and β are parameters to be estimated; p and q are the optimal lags. Traditionally, in order to analyze the long-term dynamics, it was necessary to use the Granger or Johansen cointegration tests which required that all the variables be integrated of the same order. This requirement is no longer necessary and would not be appropriate when the model contains both *I(0)* and *I(1)* variables. The correct approach is to use the "Bounds Test" proposed by Pesaran et al (2001). To conduct this test we must first determine the length of the optimal lag. We will use the Akaike Information Criterion (AIC) to determine the optimal lag that will give us the unconstrained error correction model (Pesaran et al., 2004, termed conditional ECM). Thus, this conditional ARDL model (p, q) in the case of our study is as follows:

$$\Delta lnpibh_t = \alpha_1 + \theta_1 lnpibh_{t-1} + \theta_2 lnemp_{t-1} + \theta_3 lninv_{t-1} + \theta_4 lnipc_{t-1} + \theta_5 Ausolde_{t-1} + \theta_6 lnrf_{t-1} + \theta_7 ms_{t-1} + \theta_8 ms_{t-1}^2 + \theta_9 lntde_{t-1} + \theta_{10} lnouv_{t-1} + \sum_{i=0}^{q} \varphi_1 \Delta lnpibh_{t-i} + \sum_{i=0}^{q} \varphi_{2i} \Delta lnemp_{t-i} + \sum_{i=0}^{q} \varphi_{3i} \Delta lninv_{t-i} + \sum_{i=0}^{q} \varphi_{4i} \Delta lnipc_{t-i} + \sum_{i=0}^{q} \varphi_{5i} \Delta Ausolde_{t-i} + \sum_{i=0}^{q} \varphi_{6i} \Delta lnrf_{t-i} + \sum_{i=0}^{q} \varphi_{7i} \Delta ms_{t-i} + \sum_{i=0}^{q} \varphi_{8i} \Delta ms_{t-i}^2 + \sum_{i=0}^{q} \varphi_{9i} \Delta lntde_{t-i} + \sum_{i=0}^{q} \varphi_{10i} \Delta lnouv_{t-i} + \varepsilon_{1t} \quad (6)$$

The Bounds test is equivalent to testing the following hypothesis:

$$\begin{cases} H_0: \theta_1 = \theta_2 = \theta_3 = \theta_4 = \theta_5 = \theta_6 = \theta_7 = \theta_8 = \theta_9 = \theta_{10} = 0 \\ H_1: \theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 \neq \theta_5 \neq \theta_6 \neq \theta_7 \neq \theta_8 \neq \theta_9 \neq \theta_{10} \neq 0 \end{cases} \quad (7)$$

Under the null hypothesis (H_0) there is no level relationship i.e. the series are not cointegrated. The statistic used for this test is the Wald or Fisher statistic used in the Dickey-Fuller model to assess the significance of the lag length in Pesaran's unconditional ECM (Pesaran's et al. 1999). Thus, if the null hypothesis is not rejected then we conclude that the series are not cointegrated. On the other hand, if the null hypothesis is rejected, we conclude that there is a long-run dynamic and that the series are cointegrated. A very important initial hypothesis of this procedure is that the error term of the ARDL model does not suffer from autocorrelation. Once this condition is satisfied, there is need to ensure that the model is stable.

The asymptotic distribution of the Wald and Fisher statistics are not the conventional statistics under the null hypothesis of no long-term relationship, whether the variables are *I(0)*, *I(1)* or mutually cointegrated. However, Pesearan et al (2001) have provided asymptotic critical values bounds for all classifications of the regressors into *I(1)* and / or *I(0).* Thus, if the computed F-statistics fall below the lower bound, we accept the

null hypothesis of no cointegration. In such situation we proceed to estimate the short run dynamics using Ordinary Least Squares (OLS).

If the F statistic is above the upper bound, we reject the null hypothesis and conclude that there is a long-term relationship between the variables. When this is the case, estimation of the *ARDL* model provides us with both the long run (levels equation) and short run dynamics (difference equation). If the F-statistics fall between the bounds, the test is inconclusive. In this case, knowledge of the cointegration rank of the forcing variables (explanatory variables) is required to proceed further (Peseran et al 1999).

IV. Empirical Result

5.1. Descriptive Statistics and time series characteristics of the data

We will first focus on the descriptive statistics before discussing the time characteristics of the variables. Table 1 gives an overview of our variables: Thus, over the period of analysis, average per capita GDP stood at US $ 1,500. Average tax revenues stood at $ 774 billion and reached its highest level of $ 2,947 billion in 2015. The mean wage bill to tax revenue ratio stood at 41.67%. This ratio reached its peak of 72.27% in 1993, more than twice the threshold set by ECOWAS. Another variable of interest is the gross fixed capital formation (GFCF) variable that we used to approximate the level of investment. The average of this variable over the period is 15% of GDP. Admittedly, this level of investment is very low for a country that aspires to the status of emerging economy. The highest level of this variable i.e. 29.66% was reached in 1978 at the time of what was characterized as the Ivorian economic miracle. For more than forty years, this level of investment has not been matched.

Table 1. Descriptive Statistics of selected des variables.

Variable	Obs	Mean	Std. Dev	Min	Max
$pibh_t$	**56**	1 560.838	328.158	1 154.754	2 397.092
emp_t	**56**	3 984 245	1 944 579	1 258 732	7 443 493
$fbcf_t$	**56**	15.264	5.457	8.254	29.661
ouv_t	**56**	36.751	5.548	27.674	47.535
rf_t	**56**	774.189	718.568	24.500	2 947.460
tde_t	**56**	216.536	99.116	77.000	442.000
ipc_t	**56**	46.803	36.003	5.559	110.874
$ausolde_t$	**56**	-6.610	4.164	-14.360	9.510
$msrf_t$	**56**	41.674	10.117	23.984	72.272

Source : Author's calculation

In addition to the simple descriptive statistics above, we looked at the correlation between the different variables (Table 2). We first transformed the variables by taking the logarithm except of the variable "other balance" which had negative values. We observe that there is a negative association between the employment variable and the level of GDP per capita. This association is **-0.525** and is significant. We also observe that the investment, terms of trade ($lntde_t$), and other balance ($Ausolde_t$) variables are positively associated with per capita GDP even though this association is not strong except with investment. We observe finally that the association of our variable of interest ($lnmsrf_t$) is negative and low (**-0.304**). A final element to note is the very strong association (over 0.90) between the employment variable ($lnemp_t$) and tax revenue ($lnrf_t$), terms of trade ($lntde_t$) and inflation ($lnipc_t$)..

Table 2. Pairwise correlation between the variables of interest

	lnpibh	*lnemp*	lninvt	lnopen	lnrf	lntde	lnipct	Ausolde	$lnmsrf_t$	$lnmsrfsq_t$
lnpibh	1.000									
lnemp	-0.525*[b]	1.000								
lninvt	**0.819***	-0.613*	1.000							
lnopen	-0.198	'0.641*	-0.076	1.000						
lnrf	**-0.361***	0.974*	-0.481*	0.684*	1.000					
lntde	**0.436***	-0.914*	0.577*	-0.449*	-0.876*	1.000				
lnipct	**-0.538***	0.992*	-0.622*	0.631*	0.977*	-0.907*	1.000			
Ausolde	0.460*	-0.252	0.612*	0.280*	-0.171	0.266*	-0.258	1.000		
$lnmsrf_t$	**-0.304***	0.578*	-0.642*	-0.058	0.557*	-0.628*	0.596*	-0.617*	1.000	
$lnmsrfsq_t$	-0.302*	0.560*	-0.644*	-0.085	0.536*	-0.616*	0.576*	-0.624*	-0.624*	1.000

[b] Asterisk indicates significant levels i.e. * ➔ 5%

Sources: Author'scalculations

Let's look at the time series characteristics of our variables. The stationarity tests ADF and Philip Perron(PPerron) indicate that all the variables are stationary in first difference. Thus, they are integrated of order 1 i.e. *I(1).* These results are presented in Table 3.

Variables	Levels		1st Difference		Conclusion
	ADF	PPerron	ADF	PPerron	
$lnpibh_t$, lag(2	-1.649(0.458)	-1.407(0.579)	**-3.487***(0.001)	**-5.400***(0.000)	I(1)
$lnemp_t$ lag(3)	-1.674(0.444)	**-3.588***(0.006)	**-3.802***(0.016)	**-3.829***(0.015)	I(1)
$lninv_t$, lag(1)	-1.578 (0.495)	-1.546(0.510)	**-4.442***(0.000)	**-6.828***(0.000)	I(1)
$lnouv_t$, lag(1)	-1.633(0.466)	-1.985(0.293)	**-5.916***(0.000)	**-7.937***(0.000)	I(1)
$lnrf_t$, lag(1)	-1.653 (0.455)	-1.944 (0.311)	**4.217***(0.000)	**-6.418***(0.000)	I(1)
$lntde_t$, lag(1)	-1.800 (0.380)	-1.820 (0.371)	**-6.755***(0.000)	**-9.523***(0.000)	I(1)
$lninf_t$, lag(2)	-1.505(0.531)	-1.391(0.587)	**-3.241***(0.018)	**-4.194***(0.001)	I(1)
$Ausolde_t$, lag(2)	**-3.047***(0.031)	-2.630 (0.087)	**-4.184***(0.001)	**-6.649***(0.000)	I(1)
$lnmsrf_t$, lag(1)	-2.092 (0.248)	-2.046 (0.267)	**-5.335***(0.000)	**-7.130***(0.000)	I(1)
$lnmsrfsq_t$, lag(1)	-2.125 (0.234)	-2.040 (0.269)	**-5.225***(0.000)	**-6.889***(0.000)	I(1)

Schwartz-Bayesian Information Criterion (SBIC) was used to determine the optimal lag order
Source: Author'scalculation

5.2. Do the variables exhibit long run dynamics? (cointegration test)

Notwithstanding the above results we proceed to use the Bounds test proposed by Pesaran et al (2001). This is done after we had identified the optimal *ARDL* models. The following specifications are considered: *ARDL(3,4,3,0,3,4,2,4,4)*, *ARDL(3,4,3,1,4,3,4,4)* and *ARDL(1,4,2,1,0,4,4,4)* . Regardless of the specification, the Bounds test rejects the null hypothesis of no levels relationship. The F-statistics are **23.865, 8.177** and **5.390** respectively**.** These values are all above the upper bound of the critical values at the 5% significance level. The null hypothesis of no cointegration is therefore rejected and we conclude that variables are cointegrated. The student (*t*) statistics confirm the above results.

Table 4. Results of the bound test cointegration between the variables.

lnpibh* (model 1)ARDL(3,4,3,0,3,4,2,4,4)*	***lnpibh* (model 2)***ARDL(3,4,3,1,4,3,4,4)*	***lnpibh* (model 3)***ARDL(1,4,2,1,0,4,4,4)*
H_0➔ **No levels relationship**[a]		
F-stat = 23.865	**F-stat = 8.177**	**F-stat = 5.39**
Critical Value at 5% [I(0) I(1)]	Critical Value at 5% [I(0) I(1)]	Critical Value at 5% [I(0) I(1)]
k=8 [2.22 3.39]	**k=7** [2.32 3.50]	k=7 [2.32 3.50]
t-stat= -8.379	**t-stat= -5.979**	**t-stat= -4.687**
Critical Value at 5% [I(0) I(1)]	Critical Value at 5% [I(0) I(1)]	Critical Value at 5% [I(0) I(1)]
k=8 [-2.86 -4.72]	**k=7** [-2.86 -4.57]	**k=7** [-2.86 -4.57]

[a], Reject $H_0 si F_{stat} > F_\alpha$ for I(1); Reject $H_0 si t_{stat} < t_\alpha$ for I(1).
Sources : Authors' estimation

Based on the above results, we estimated our error correction models, the results of which are shown in Table 5 where we present the long and short run dynamics. In model 1, the error correction coefficient is negative and significant. This results is important as it confirm the Bounds test results of cointegration among the variables. We observe that employment ($lnemp_t$), tax revenue ($lnrf_t$) and other balance ($Ausolde_t$) have positive impact on the country's economic growth in the long run. There is therefore a long run causality running from these variables to economic growth. Theterms of trade variable (*lntdet*) and inflation variable ($lninf_t$) have a negative impact of the country's economic performance. The wage bill to tax revenue ratio variable ($lnmsrf_t$) which is our variable of interest is positive and significant. This indicate that in the long run, the country's economic performance improves with increases in the wage bill to tax revenue ratio.

Table 5. Results of the estimated long run coefficients of the *ARDL* models of the impact of wage bill to tax revenue ratio on economic growth in Côte d'Ivoire.

	Model 1ARDL(3,4,3,0,3,4,2,4,4)	**Model 2**ARDL(3,4,3,1,4,3,4,4)	**Model 3**ARDL(1,4,2,1,0,4,4,4)
	Long run dynamics		
ECT_{t-1}	**-0.984*****[b] **(0.000)**[a]	**-0.724***** **(0.000)**	**-0.624***** **(0.000)**
$lnemp_t$	**0.263******(0.021)**	**0.355**** **(0.017)**	**0.463**** **(0.033)**
$lninv_t$	**-0.193*******(0.003)**	-0.054 (0.494)	-0.106 (0.180)
$lnrf_t$	**0.467*******(0.000)**	**0.288***** **(0.000)**	**0.398***** **(0.000)**
$lntde_t$	**-0.121******(0.014)**		-0.073 (0.261)
$lninf_t$	**-0.917*******(0.000)**	**-0.672***** **(0.000)**	**-0.909*******(0.000)**
$Ausolde_t$	**0.012*******(0.000)**	0.002 (0.643)	
$lnmsrf_t$	**2.919*******(0.002)**	**2.687*** **(0.064)**	**3.751*** **(0.068)**
$lnmsrfsq_t$	**-0.375*******(0.003)**	**-0.355*** **(0.060)**	**-0.492*** **(0.068)**
Threshold	***48.818***	***44.036***	***45.346***
Significance of the threshold $\chi^2_{(1)}$	**2818.570*******(0.000)**	**937.600*******(0.000)**	**2096.260***** **(0.000)**
	Short run dynamics		
$lnpibh_t$			

LD	**-0.226** (0.047)	**-0.303** (0.011)	
L2D	**-0.246** (0.026)	**-0.224** (0.054)	
$lnemp_t$			
D1	**1.478** (0.005)	0.546 (0.277)	0.438 (0.440)
LD	**1.483** (0.002)	**0.856** (0.065)	0.415 (0.420)
L2D	0.310 (0.413)	0.315 (0.445)	0.014 (0.978)
L3D	0.420 (0.280)	**0.910** (0.030)	0.794 (0.109)
$lninv_t$			
D1	**0.124** (0.009)	**0.084** (0.091)	0.049 (0.251)
LD	**0.146** (0.004)	**0.118** (0.027)	**0.097** (0.033)
L2D	0.042 (0.297)	0.046 (0.251)	
$lntde_t$			
D1	0.050 (0.422)		
LD	-0.041 (0.491)		
L2D	**-0.154** (0.025)		
$lnrf_t$			
D1		0.122 (0.118)	0.138 (0.157)
$lninf_t$			
D1	-0.015 (0.904)	-0.007 (0.963)	-0.124 (0.462)
LD	0.010 (0.929)	0.151 (0.199)	**0.219** (0.068)
L2D	**0.474** (0.000)	**0.429** (0.001)	**0.452** (0.001)
L3D	**0.216** (0.025)	**0.372** (0.003)	**0.298** (0.017)
$Ausolde_t$			
D1	**-0.009** (0.000)	-0.0002 (0.943)	
LD	-0.003 (0.136)	**0.005** (0.075)	
L2D		**0.006** (0.028)	
$lnmsrf_t$			
D1	**-1.577** (0.029)	**-1.191** (0.099)	-0.714 (0.400)
LD	-1.025 (0.157)	-0.502 (0.493)	-1.398 (0.086)
L2D	-0.432 (0.589)	-1.091 (0.179)	-2.536 (0.003)
L3D	**-1.517** (0.011)	**-1.261** (0.044)	**-2.465** (0.000)
$lnmsrfsq_t$			
D1	**0.235** (0.018)	**0.197** (0.047)	0.115 (0.318)
LD	0.159 (0.112)	0.090 (0.349)	**0.193** (0.075)
L2D	0.053 (0.637)	0.165 (0.121)	**0.342** (0.003)
L3D	**0.200** (0.013)	**0.172** (0.038)	**0.324** (0.001)
Constant	-0.862 (0.725)	-1.847 (0.488)	-3.470 (0.279)
Adj R-squared	0.892	0.857	0.769
Threshold	***28.541***	***20.559***	***37.403***

[a] Number in parenthesis are p-values; [b] Asterisk indicates significant levels i.e. * ➔ 10%, ** ➔ 5% and *** ➔ 1%.

The quadratic term of this variable is negative and significant indicating that the improvement resulting from increased wage bill to tax revenue ratio is up to a threshold. Here, the estimated threshold is **48.81%.** Beyond this threshold any additional increase of the wage bill to tax revenue ratio will negatively affect the country's economic performance.

We conducted some sensitivity analysis by dropping selected variables from model 1 to see if the results will change significantly. Thus, the second model was estimated without the terms of trade variable. The results did not differ much. Indeed, the error correction coefficient is still negative and significant. Our variable of interest is positive and significant whereas its quadratic term is negative and also significant. The estimated threshold with this specification is **44.036%**. In the last specification we dropped the other balance variable ($Ausolde_t$). The results did not change much and our variables of interest have the expected signs and they are significant at the 10% probability level. The estimated threshold for this last specification is **45.346%**.

We observe that in the short run, employment and the investment variables have positive and significant impacts on the country's economic growth. There is therefore a short run causality running from these two variables to economic performance.

Unlike the long run dynamics, in the short run, the coefficient associated with the wage bill to tax revenue ratio variable is negative and significant whereas its quadratic term is positive and also significant giving a U-shape. This result indicates that the positive impact of the wage bill to tax revenue ratio on economic performance starts at a given level. This level in the case of our model 1 is **28.54%.** Thus, reducing this indicator to a level below this threshold will be counterproductive for the country. The other specifications provide similar results although the thresholds differ. Thus, for model 2. The threshold stood at 20.56% and for model 3 it is at **37.40%.**

The diagnostic tests presented in Table 6 give us an indication of the model that is more appropriate. From the autocorrelation, homoscedasticity and normality tests, all three models are valid. However, looking at the cumulative sum of squares graphs we find that only models 1 and 3 are stable.

When we consider model 1, the minimum level of the wage bill to tax revenue ratio is **28.54%.** Below this level, wage bill restrictions will be counterproductive.

If we consider model 3, we find that in the short run given the U-shape, the threshold of **37%** (which is above the actual threshold set at 35%) is the minimum level of the wage bill to tax revenue ratio from which this indicator starts having a positive impact on economic performance. Below this level, it hampers efforts to improve economic growth.

Table 6. Diagnostic tests for the estimated *ARDL* models.

Model 1 ARDL(3,4,3,0,3,4,2,4,4)	***Model 2*** ARDL(3,4,3,1,4,3,4,4)	***Model 3*** ARDL(1,4,2,1,0,4,4,4)
Breusch-Godfrey LM test for no autocorrelation		
$\chi^2_{(1)}$ 2.451 (0.117)[a]	0.907 (0.341)	2.753 (0.097)
White's test for Ho: homoscedasticity		
$\chi^2_{(51)}$ 52.000 (0.435)	52.000 (0.435)	52.000 (0.435)
Test for Normality		
$\chi^2_{(54)}$ 83.600 (0.583)	76.050 (0.746)	77.610 (0.523)

The stability testsare given by the CUSUMSQ graphs presented in the annex to this paper.
[a] Number in parenthesis are p-values
Source: Author's calculation

The immediate implication is that, all things being equal, *ceteris paribus*, with the current level of this indicator at **45% in 2015**, the country has reached the critical threshold of the ratio of wage bill to tax revenues, beyond which any increase could harm its economic growth. It is therefore recommended that the country endeavors to maintain this indicator at that level or manage to reduce it so it remains below the estimated threshold.

V. Conclusion

The objective of this study was to contribute to a better understanding of the relationship between economic growth and the ratio of wage bill to tax revenue. The study began with a trend analysis. The different episodes of changes in the country's wage bill and tax revenues were presented as well as their importance in total revenue and total expenditure respectively. The study reviewed both theoretical and empirical literature on arguments for or against the threshold set for this indicator. The data used ranged from 1960 to2015. The authors used bounds tests in an ARDL setting to investigate the existence of long run dynamics among the variables. The findings suggest that: 1) there exist a long-term relationship between the country's economic performance and the wage bill to tax revenue ratio; 2) there is an optimal threshold in the long run for the wage bill to tax ratio. Beyond this threshold, any increase in this indicator would be detrimental to economic growth. The estimated threshold in the long run is **48.81%** for model 1 and **45.34%** for model 3. This optimal thresholds are above the limit imposed by ECOWAS of **35%** and which served as a convergence criterion. Although this criterion is no longer among the convergence criteria for the ECOWAS Commission, the West African Economic and Monetary Union i.e. a grouping within ECOWAS, continues to use it. It is therefore important for this countries to revisit the currently set threshold. The study also found a minimum threshold below which the country's economic performance will be negatively impacted. This minimum threshold is **28.54%** for model 1 and **37%** for model 3.

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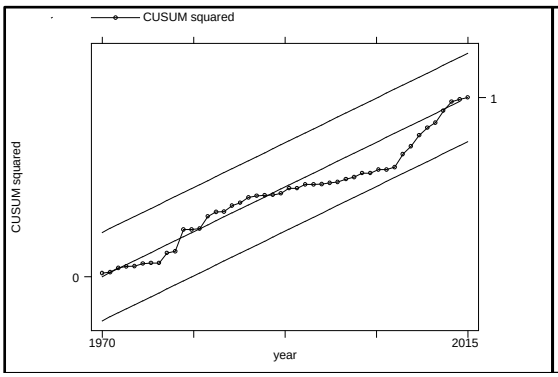
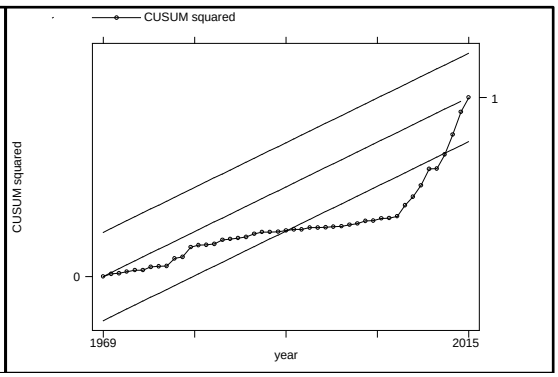
Annex

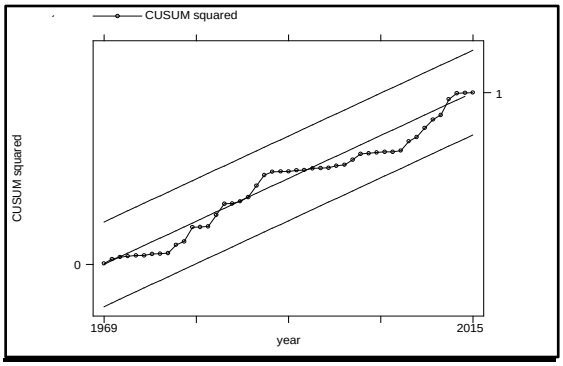
Model 1



Model 2



Model 3



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