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Abstract

This paper studies the impact of taxation on economic growth of the eight WAEMU countries. Among the critiques addressed to the public sector, numerous are those that refer principally to the negative effects which entail high weight and increasing of taxation. The growth rate can be influenced by economic policy choice relative to taxation which has an effect on the decisions of economic agents and is due to the productive public expenditures. The reason is that high level of taxation can be distortionary and like this negatively influences economic growth while law weight of taxation can generate some returns which will be enclosed in production. In order to catch this phenomenon in the WAEMU countries, we have contrary to the more previous studies accounted a non-linear effect of taxation on economic growth. Mobilizing a dynamic panel data specification over the period 1989–2012, the econometric results suggest the absence of a non-linear relationship between taxation and economic growth of WAEMU. Specifically, weak and high rates respectively at short run and long run do not create distortions and hence affect positively economic growth of WAEMU and generate income. This effect on economic growth then increase over time as the fiscal revenue increase.

JEL CODES : C33; H20; H21; H27; O40.

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1. Introduction

Recent studies (Easterly and Rebelo, 1993 ; Nelson and Singh, 1994; Devarajan, Swaroop and Zou, 1996 ; Barro, 1997 ; Tanzi and Zee, 1997 ; Nubukpo, 2007) analyze the impact of public expenditures on economic growth and arrive at the contradictory results which show the difficulty to establish with certainty the sense, the nature and the significance of the impact of public expenditures on economic growth. The absence of empirical evidence robustness relative to the relationship between public expenditures and economic growth can be partly due to the non linear relationship between these variables. In other terms, negative relationship between public expenditures and economic growth is due to the distortionary effect that high income taxes use on economic growth. Indeed, one of the fundamental questions in macroeconomics and public finances is how changes in fiscal policy affect economic activity and social welfare. Then, is there a clear relationship between the taxes collected by a country and his economic performances ?

Indeed, growth rate can be influenced by economic policy choices relative to taxation which has an effect on economic agent decisions and is due to the public expenditures productive. Taxation can have both a negative and positive effect on economic growth. The negative effect is due to the distortions in choices and effects of discouragement factors. The positive effect is due indirectly to the expenditures financed by the taxation. The endogenous growth model with a public good as input provides a positive channel through which taxation can increase economic growth. The relationship is not monotonous because an increase of tax rate over the optimum reduces the growth rate. In practice, the economies can be situated on both sides of the optimum. Similarly, an evidence of simulations provides a vast range of estimation with law significant of taxation effect on growth. Thus, since the theory is not conclusive about the taxation effect on growth, it is therefore natural to turn to the empirical evidence (Myles, 2009).

One of the macroeconomic convergence criteria of West-African Economic and Monetary Union (WAEMU)[2] aims to reach a minimum fiscal pressure rate of 17% in the different economies. However, although taxation differs from one country to another, so much in his structure and at the level of the rates used, sometimes with deep disparities, the average rate of tax pressure in recent years in these countries is generally lower than those set by the WAEMU.

In cause, the difficulties encounter by the Governments in enlargement of taxable base especially in reason for no taxation of a large part of economy (agriculture for example), of importance and

[2] WAEMU regroups eight countries (Benin, Burkina, Ivory Coast, Guinea Bissau, Mali, Niger, Senegal, Togo) having in common the usage of franc CFA and the Central Bank of West-Africa Countries (BCEAO).

rapid development of the informal sector during the last years. Besides, tax evasion and fiscal fraud, as fiscal and customs exonerations limit the performances of financial administrations. This situation is accentuated by the ineffectiveness of fiscal control due to human resource problems in the financial administrations and to the unsuitability of encouragement measures compared with sought-after aims. At this rhythm, the governments of the Union do not arrive to bring together in great quantity sufficient returns to cover priority needs when one knows that budgetary returns constitutes an essential instrument of the development strategies.

In the objectives to improve their national fiscal policy and to be registered in the dynamics of the convergence criterions realization defined by the WAEMU, the governments are resolutely committed in the fiscal reforms. However, do not overlook the negative effects of too heavy taxation and fiscal pressure in total phase with economic reality of the sub-region, since policymakers and economists warned that excessive taxation is costly for the government in terms of economic growth and tax revenues[3].

Indeed, most the WAEMU countries are among the poorest of the world and for some prey to socio-policy instability. There is therefore much to do about attracting investors but also to recover the taxes paid by enterprises and populations. In such context, does not the WAEMU earn to propose some more supple criterions of macroeconomic convergences, particularly those relative to taxation? The answer for such question requires a clear knowledge of the relationship between taxation and economic growth of WAEMU countries.

Theoretically, it usually considers that tax have a negative correlation with economic growth. Like this, high taxes rates mean law economic growth rates. This is explained by the act that taxation introduces distortions in the economy, because they have not a neuter effect on the individual behavior. All taxes except fixed tax (only neuter tax, though impossible to determine it in practice) introduce distortions in an economic system. The distortionary[4] tax changes the system of individual stimulation, like this their decisions for example on labor and leisure or saving and consummation are different of that they would be in non-tax environment. The distortions that

[3] Arthur Laffer was one of the pioneers who illustrate formally the idea of a non linear relationship between tax rate and growth. He points out that, for a given economy, there is a fiscal level effort beyond which taxation is damageable for economy.

[4] In practice, most of taxes are distortionary in the opposed direction from fixed taxes; ceteris paribus, they have therefore tendency to deform resource allocation through their impact on saving and investment. However, the act that they have or no a perverse effect on growth in the net terms depends on profits in terms of the expenditures growth that they serve to finance. More generally, there is not all the distortionary taxes that have some adverse effects on economic growth at long-term; the net effect depends on the fact that the considered tax is or no used as an instrument to correct negative externalities or other distortions. The impact of taxation on the level of investment operates through the capital cost. The evidence of this effect is limited for developing countries. The taxation can nevertheless affect investment through a differentiated structure of the profits taxation rate (See Agénor, 2005).

taxes introduce in the economy result from the reduction of efficacy. Therefore, high taxes rates mean high distortionary rates.

Though, the theory underlines especially a negative relationship between taxation and economic growth, the empirical research provide non ambiguous results. Indeed, recent studies analyzed the empirical impact of taxation on economic growth (Myles, 2009; Harberger, 1964, Mendoza et *al*., 1995; Engen and Skinner, 1992 and 1996; Easterly and Rebelo, 1993 ; McDermott and Wescott, 1996 ; Alesina and Perotti, 1996 ; Xu, 1994 ; Milesi-Ferretti and Roubini, 1995 ; Cashin, 1994 ; Tanzi and Schuknecht, 1995 ; Leibfritz and *al*., 1997; Skreb, 1999 ; Dackehag and Hansson, 2012 ; Arnold and *all*., 2011; Lee and Gordon, 2004; Arseneau and *al*., 2011; Ebrahimi and Vaillancourt, 2012; Padovano and Galli, 2001; Widmalm, 2001; Mutascu and Danuletiu, 2011; etc.) and are obtain non consensual clear results as the theory suggests. The different results obtained by these studies do not permit to draw univocal conclusion about the negative impact of taxation on growth. Some things are in cause namely: (*i*) different definitions of state in different countries and periods (whether it is a central government or general government with extra-budgetary funds and local governments), which means different levels of taxation; (*ii*) problems of measuring of individual tax variables, such as marginal tax rates (Easterly and Rebelo, 1993; Engen and Skinner, 1996); (*iii*) difficulties in sorting out the impact of individual tax variables on growth, because of complex interactions of fiscal variables (tax increase does not have to reduce growth if such increased taxes are used for financing those forms of public investments that will increase productivity of private investments, thus stimulating growth); (*iv*) difficulties in separating the impact on growth of other economic variables from the impact of fiscal variables only; (*v*) it has turned out that quantitative results are very sensitive to the parameters the values of which have still not been estimated reliably (e.g. elasticity of intertemporal substitution, labor supply elasticity, depreciation rate of human capital etc) (Xu, 1994); (*vi*) lack of empirical data enabling unambiguous acceptance or rejection of a conclusion of some theoretical model.

Indeed, using the personal income tax on corporate income, land tax and consummation tax in a panel for 21 OECD countries from 1971 to 2004, Arnold et *al.* (2011) found that 1% increase of consummation returns taxes compared with income tax increases GDP per capita for 0.74% at long-term. Using also a panel for 70 countries through the world from 1970 to 1997, Lee and Gordon (2004) found that a decrease with 10% for the corporate tax result in an increase with 1% to 2% for the annual growth rate. They found a positive correlation between returns of personal taxes and taxation rate of the corporate income. Arseneau et *al.* (2011) use a panel for 19 OECD countries from 1972 to 2007 (5-year averages) and found that an increase for 0.1 point of

the consummation tax ratio on the personal income tax results in an increase of GDP per capita for 0.12%. These effects are non significant for the other types of taxes.

Controlling the level of GDP in the beginning of each period, physical capital, human capital, trade openness and fiscal returns, Ebrahimi and Vaillancourt (2012) obtain a negative impact of taxation on GDP per capita growth rate for the Canadian provinces. This impact changes from one tax to another: Consummation tax and corporate income tax have more high negative effect on growth rate compared with personal income tax. They found that the significance level of the annual panel data variables is higher than the one of panel data variables with 5-year averages.

In the same way, considering a panel of 25 rich OECD countries for the period 1975-2010, Dackehag and Hansson (2012) find negative relationship between income tax (corporate income tax and personal income tax) and economic growth. They have also tested and obtained an empirical non-linear relationship between corporate income tax, personal income tax and economic growth. Thus, law levels of income tax influence positively economic growth when high levels of this tax decelerate it.

Padovano and Galli (2001) use a panel of 23 OECD countries for the period 1961-1990 (10-year average) and found that one unit increase of the marginal tax rate results in 0.011 unit increase of GDP growth rate in average.

Using a panel of 23 industrialized OECD countries between 1965 and 1990, Widmalm (2001) found that 1% increase of the returns tax coming from personal income tax results in about 2% increase of the average GDP growth rate.

Ogbonna and Ebimobowei (2012) worked with Nigeria data on the period 1994-2009 and found that fiscal reforms are significantly and positively correlated with economic growth and that these fiscal reforms cause economic growth à la Granger.

In short, there is an absence of consensus on the size and the sense of the relationship between taxation and economic growth because of the ambiguity of the relationship between the two variables due fundamentally to distortionary effects of taxation on economic growth. When we analyze the stylized acts of the WAEMU countries (See figures 2-9 of appendix C), it appear that the evolutions of tendencies for fiscal returns ratio and economic growth rate per capita of the WAEMU economies are always in phase. The tendencies slopes of the fiscal returns ratio are relatively very steep compared with those of growth rate per capita relatively weak. Thus, in a context of harmonization of national fiscal policies within the WAEMU in accordance with the convergence criterions defined by the Union and especially in the prolongation of the reflections

relative to the factors growth within developing countries of post-structural adjustment, it is important to evaluate the impact of taxation on growth for the WAEMU countries.

The following of this paper is organize as this: in section 2, the model of regression is presented, section (3) presents the source of data, the model estimations are presented in section (4), section (5) presents results and interpretations, and finally, section (6) concludes.

2. Model

We use a model of panel data which has for objective to quantify the behaviors concerning economic growth of WAEMU countries moreover in their individual differences than in their dynamic properties. We draw up with that in mind, an econometrical model in which the characteristics of each country are taking into account as specific effects which are variables observed, constant in time period and supposed to influence their behaviors. Accounting the sources of unobservable heterogeneity allow to complete the heterogeneity of the observables variables introduced in the model. The model of regression that we estimate must be writing as follows:

$$y_{it} - y_{it-1} = (\alpha - 1) y_{it-1} + \beta x_{it} + \gamma z_{it} + \mu_i + \delta_t + \varepsilon_{it} \qquad (1)$$

where y_{it} represents the dependent variable, the GDP growth rate per capita of country *i* at the date *t*, x_{it} is the variable of taxation (fiscal returns ratio) of the country *i* at time periode *t* and represents the important variable of our study, z_{it} is the explanatory variables vector (income, private investment, trade openness, population dependence ratio, labor force growth rate, public expenditures ratio, saving as share of GDP ratio, the logarithm of the initial income per capita is measures by the logarithm of initial GDP per capita of every under period). The term μ_i represents countries fixed effect (non measurable shocks). The terms δ_t represent the sample effect in time period (temporal specific effect). This term represents the trend which affects economic growth of each country as businesses cycle. The fiscal returns are probably affected by this event. The error terms ε_{it} represent the idiosyncratic distributions which change by country and in time and are supposed to be *iid* (independently and identically distributed) with zero average and σ_ε^2 as variance. As we have already underlined it; *i* and *t* represent respectively country and temporal index. α, β and γ are the parameters to be estimated.

The study about the relationship between taxation and economic growth can be faced some statistical problems. One of them is endogeneity problem. The fiscal policy can at a time period influence economic growth and must be influenced by economic growth. High tax rates can

result in weak economic growth rate, on the other hand, periods of weak economic growth can require high tax rates in the objective to finance the expenditures increase due for example to the unemployment rate increasing. To solve this problem, we used 4-year averages of the GDP per capita growth rate and other explanatory variables. Besides, we use GMM in dynamic panel of Arellano and Bond (1991) which provides solutions to the multiple problems of simultaneous bias, inverse causality and omitted variables.

We can rewrite equation (1) as follows:

$$y_{it} = \alpha y_{it-1} + \beta x_{it} + \gamma z_{it} + \mu_i + \delta_t + \varepsilon_{it} \qquad (2)$$

Where $y_{it} = txcroispibpt_{it}$, $x_{it} = \left[revtax_{it} \quad revtax_{it}^2 \right]'$,

$z_{it} = \left[invpri_{it} \quad ouvcom_{it} \quad depop_{it} \quad txcroisft_{it} \quad dpgov_{it} \quad epnat_{it} \quad infl_{it} \quad lrevintp_{it} \right]'$

$\beta = \left[\beta_1 \quad \beta_2 \right]$ and $\gamma = \left[\gamma_1 \quad \gamma_2 \quad \gamma_3 \quad \gamma_4 \quad \gamma_5 \quad \gamma_6 \quad \gamma_7 \quad \gamma_8 \right]$.

txcroispibpt : is GDP per capita growth rate allowing to measure the inhabitants prosperity.

revtax : is the fiscal returns ratio measured by the fiscal returns as a share of GDP (in %). The fiscal returns are equal to the sum of fiscal returns from all forms of taxation imposed by the WAEMU countries governments. We make out two types of fiscal returns: direct *taxes* are those which are supported directly by the people who are subject to the tax. They are recovered with a roll, that is-to-say a nominative list of the taxpayers. These latter cannot carry over the tax costs on other economic agents, at the difference of indirect taxes which are the taxes on expenditures that are incorporated in goods prices and consummate services. It exists two categories: the Value-Added Tax (VAT), base on consummation, and the indirect taxes, specific taxes relative to some products or determined activities. In practice, most regulate taxes are distortionary opposed to the fixed taxes; ceteris paribus, they have therefore tendency to deform allocation resource through their impact on saving and investment. However, the act that they have or not a perverse effect on economic growth in net terms depends on the profits in terms of the expenditures growth which they serve to finance. More generally, that is not all the distortionary taxes which have some adverse effects on economic growth at long-term; the net effect depends because of the considered tax is or not used as an instrument to corrects the negative externality or other associated distortions. The impact of taxation on the level of investment operates through the capital cost. The evidence of this effect is limited for the developing countries. The taxation can nevertheless affects the investment composing through a differentiated structure of the profits taxes rate (Agénor, 2000). This one considers that in the total of fiscal returns, relative shares of direct taxes, taxes on goods and services, and taxes on exterior trade change considerably

between developing countries and in time. Besides, concerning the direct taxes, the share of fiscal returns draw from physical person income taxes in developing countries is higher than those one due by enterprises. The fiscal returns of WAEMU countries represent more than 127 % of his returns in 2012 (See figure 1 of appendix C) showing that the essential public returns of the WAEMU countries come from fiscal returns. They permit to the governments of Union to lead their different public policies. Finally, because of the distortionary effects that increase income taxes can exercise on economic growth, it appears difficult to express an opinion *a priori* on the expected sign of such relationship in the framework of WAEMU.

invpri : is the private investment. It is a factor of economic growth moreover for the neoclassic school than the Keynesian theory. It is measured by the ratio of private gross fixed capital formation as a share of GDP (in %). In practice, most of taxes have tendency to deform allocation resource through their impact on investment and also on saving. Private investment is susceptible to cause externalities effects in accordance with the recent results of endogenous growth models (Guellec and Ralle, 1997). Indeed, an enterprise investment allows to this one to increases not only his production, but also the one of other enterprises, because of the technological externality which it causes. Thus, some empirical studies on African economies (Ojo and Oshikoya, 1995; Ghura and Hadjimichael, 1996) have highlighted the presence of a positive relationship between investment and GDP growth per capita.

ouvcom : is the openness trade calculate by the sum of export and import of the WAEMU as a share of GDP (in %). It needs to underline that there is all a discussion on the calculation of the openness trade indicator (See Siroën, 2000). The indicators proposed today in the literature are multiple. Some among them need to build an important data base and serve as "public goods" for more recent studies. That is notably the case of the indications calculated by Leamer (1988), Barro and Lee (1994), Sachs and Warner (1995). The quasi-totality of the studies concludes to the existence of a positive relationship between development and the openness trade. Besides, it needs that the measure of the two indicators does not conduct to the ambiguous results. One will find a synthesis of empirical studies notably in Edwards (1993) or Serranito (1999). It is *a priori* difficult to predict the sign of openness trade on economic growth for the WAEMU countries seeing that these ones import much more than they do not export and the strong dependence of their exports to the raw materials submitted to the foreign terms deterioration and, the weakness of the intra zones trade.

depop : is the population dependence ratio. This ratio takes in account the share of population who not work and in charge to the active population. That is the population aged 0-14 and upper 65 as a share of the total population. This variable is supposed to be correlated negatively with

the economic growth rate per capita because of the relative importance of the population aged 0-14 (around 45% of the total population).

txcroisft : is the growth rate of labor force (in %). It allows catching the workload make in an economy. This workload proportional to the active population is supposed to influence positively the production, with a threshold effect, because of the decreasing marginal produces (Nubukpo, 2007).

dpgov : is the ratio of the public expenditures measured by the total of public expenditures as a share of GDP (in %). It appears difficult being pronounced *a priori* on the expected sign of the relationship between public expenditures and economic growth rate of the WAEMU countries because of the wealth and the diversity of empirical results relative to the impact of public expenditures on economic growth. Nevertheless, using public consummation ratio as a share of GDP (in %) over the period 1971-1995, Tenou (1999) obtains a negative relationship with economic growth in the WAEMU countries. In return, the coefficient which is found (-0,158) is the same in absolute value that the one obtained for total investment (public and private) rate (0,159), that conduct to make undetermined the effective impact of the public expenditures on economic growth of WAEMU economy.

epnat : is the ratio of saving measured by the domestic saving as a share of GDP (in %). In practice, most regulate distortionary taxes have tendency to deform resource allocation through their impact not only on the saving but also on the investment. We expected a positive sign on economic growth of WAEMU countries.

infl : is the inflation rate (annual in %) in the WAEMU countries. This rate keeps ambivalent relationships with economic growth rate (Nubukpo, 2007). The non negligible agricultural production share in the composition of global supply offers in the sub-Saharan countries and the deflationist impact on the food goods generally due to a good agricultural campaign, justify the hypothesis of the existence of an inverse relationship between global supply and inflation. However, the increasing of inflation rate can also be indicative of a "demand effect" result within the economy. Consequently, a high inflation can be the sign of an economy in growth, following to the Keynesian hypothesis, illustrated by the Phillips curve. In all, the expected sign of this variable is *a priori* undetermined, in the sense that the value of his parameter depends on the relative evolutions of the supply money, of the demand money and the supply shock.

lrevintpt : is the initial income per capita measured by the logarithm of the initial GDP per capita of every under period. This variable which is appearing only in the second estimation allows taking in account conditional convergence (to the starting point). Solow (1956) model predicts

that the economies that having an initial income level little high grow more quickly than those in which the income level is more important and near their stationary state. Thus, we expected to a negative sign of his coefficient for economic growth rhythm of WAEMU countries having a higher initial GDP per capita is weaker than the one of WAEMU countries having a weaker initial GDP per capita.

dummies variables : apart from the model variables, six dummies temporal variables (*dumpt*1, *dumpt*2, *dumpt*3, *dumpt*4, *dumpt*5 and *dumpt*6) and eight dummies individual variables (*dumdev* , *dumbur*91, *dumcd*98, *dumcd*10, *dumma*92, *dumnig*92, *dumsen*99 and *dumtg*91) have been introduced in the model. The dummies temporal variables are introduced in the model because on the six periods, the first is not taken in account in the regressions for the presence of the lagged dependent variable. The variables *dumtp*1, *dumtp*3 and *dumtp*6 appear in the first estimation while *dumtp*2, *dumtp*3, *dumtp*4 and *dumtp*5 in the second. The reasons of the introduction of the dummies variables in some studies on the WAEMU countries are limited. According to Nubukpo (2007), apart from the boom beginning of the raw materials (Niger in 1973-1975, Ivory Coast in 1975), the dryness that Senegal knew in 1973-1974, the policies crisis (Benin in 1989, Togo in 1993) and the change of the franc CFA party in 1994, it is the beginning of the public finance cleansing process with the structural adjustment programs adopted by the countries of the Union in the beginning of 1980 (between 1979 and 1983) which explains the presence of dummies variables in some estimations. By another way, the policy unrest in Mali (1991-1992) and in Togo, their consequences on Burkina, frontier country, in a context of starting in this country of the structural adjustment programs (1991) and the unballastings in Senegal (Nubukpo, 2003). The grave crisis of treasury in Niger in 1992 and more recently, the policy unrest in Ivory Coast (2010-2011) are the other reasons for the introduction of dummies variables in our model.

3. Data

We use a dynamic panel[5] of the eight (8) WAEMU countries observed over the period 1989-2012 to analyze the impact of taxation on economic growth. The data come from the statistics tables of the World Bank (World Tables) and the BCEAO statistics (BASTAT).

The unit root tests on panel data of Im-Pesaran-Shin and Levin-Lin-Chu show that all the variables are stationary in level, most of them with trend and constant, except the dependence ratio (annual) which is quasi-stationary in level (See table 4 of appendix B)[6].

[5] Panel data constitute an extremely rich source of information allowing studying the phenomenon in their diversity as in their dynamics.

[6] These tests are only possible for a balanced panel.

4. Estimations

The presence of the lagged dependent variable in equation (2) does not permit to use technical standards econometrics[7]. One uses the Generalized Method of Moments (GMM) in dynamic panel which allows controlling the individual and temporal specifics effects, and resolves like this the endogeneity bias of the variables, the simultaneous bias, and the inverse causality and omitted variables problems. We distingue two types of estimators: the estimator of Arellano and Bond (1991) or GMM in difference and the estimator of GMM in system. Note that the using of these two estimators presupposes the quasi-stationarity of equation variables in level, and the absence of residuals autocorrelations.

In the estimation of Arellano and Bond (1991), the strategy to answer a possible variable omitted bias due to the specific effects is to differentiating equation (2) in level. We obtain the following equation:

$$y_{it} - y_{it-1} = \alpha\left(y_{it-1} - y_{it-2}\right) + \beta\left(x_{it} - x_{it-1}\right) + \gamma'\left(z_{it} - z_{it-1}\right) + \left(\delta_t - \delta_{t-1}\right) + \left(\varepsilon_{it} - \varepsilon_{it-1}\right) \qquad (3)$$

The first difference eliminates the countries specific effect and consequently the bias of the omitted variables invariant in the time. By construction, the term $\left(\varepsilon_{it} - \varepsilon_{it-1}\right)$ is correlated with the lagged variable in difference $\left(y_{it-1} - y_{it-2}\right)$. The first differences of the explanatory variables of the model are instrumented by the lagged values (in level) of those same variables. The objective is to reduce the simultaneous bias and the bias due to the presence of lagged dependent variable in difference in the left of equation (3).

Under the hypothesis that the explanatory variables of the model are weakly exogenous (they can be influenced by the past values of the growth rate, but still no correlated to the error term future realizations) and that the errors terms are not autocorrelated, the following moments conditions are apply to the equation in first difference.

$$\mathbb{E}\left[y_{it-\tau} \cdot \left(\varepsilon_{it} - \varepsilon_{it-1}\right)\right] = 0 \quad \text{for} \quad \tau \geq 2; t = 3,\ldots,T \qquad (4)$$

$$\mathbb{E}\left[x_{it-\tau} \cdot \left(\varepsilon_{it} - \varepsilon_{it-1}\right)\right] = 0 \quad \text{for} \quad \tau \geq 2; t = 3,\ldots,T \qquad (5)$$

[7] The technical standards econometrics as the OLS do not permit to obtain efficiency estimations of such model because of the presence of lagged dependent variable on the right of equation (See Sevestre, 2002) and individual heterogeneous of errors terms.

$$\mathbb{E}\left[z_{it-\tau} \cdot \left(\varepsilon_{it} - \varepsilon_{it-1} \right) \right] = 0 \quad \text{for} \quad \tau \geq 2; t = 3, \ldots, T \tag{6}$$

The problem with this estimator is the weakness of instruments that results in considerable bias in the finite samples and his precision is asymptotically weak. More precisely, the lagged values of the explanatory variables are weak instruments of the equation in first difference. By another way, the differentiation of the equation in level eliminates the inter-countries variables and takes in account only the intra-countries variations. The GMM estimator in system allows resolving this problem (See appendix A).

5. Results and interpretation

This subsection presents estimations results of equation (3). These results are obtained from two specifications of our model. The first estimates the model on panel data where dependent variable, GDP per capita growth rate and independent variables except the dummies variables corresponding simultaneously with *individual i* (country) and *time period t* (year). The second estimates the model always on panel data where the dependent variable, the GDP per capita growth rate and the independent variables except the dummies variables and initial income per capita corresponding simultaneously with *individual i* (country) and *time period t* which is now 4-year averages annual data. Concretely, the data are 4-year averages over the period 1989-2012 (6 under periods of 4-year). This procedure allows attenuating the effect of shocks associated to the economic cycles on economic growth. In this perspective, the fiscal returns ratio average is the one of the four previous years to allow an impact on price adjustment and economy resources allocation.

Table 1 (See appendix B) presents the estimation results for the impact of taxation on economic growth rate per capita of WAEMU countries. In this table, estimations (1)-(4) are in the first category of specification and estimations (5)-(8) are in the second.

The coefficient of fiscal returns ratio on GDP is significant in the estimations (1), (2), (5) and (6) and positive that is 0.531, 0.858, 0.568 and 1.153 respectively. This coefficient has the same positive sign in the other estimations where it is not significant. This suggests that for a given level of fiscal returns and other explanatory variables, there is a positive relationship between fiscal returns ratio and GDP per capita growth rate. Contrary to the most previous studies, we consider a non-linear effect of taxation on economic growth. The reason is that high levels of taxation can be distortionary and thus affecting negatively economic growth while weak taxation rate can generate incomes which are invested in the production. We found in discordance with Arthur Laffer curve that there is not a non-linear relationship between taxation and economic

growth of WAEMU. The coefficient of fiscal returns ratio on GDP squared is not significant in all estimations but has a negative sign except in estimation (2) where this coefficient is significant and also negative (-0.010). This only exception in estimation (2) on the eight estimations (1, 3, 4, 5, 6, 7, 8) is not sufficient to consider that there is a non-linear relationship between taxation and economic growth of WAEMU. Thus, the absence of a non-linear relationship suggests that high and weak levels of fiscal returns ratio are favorable for economic growth per capita.

The coefficient of private investment is significant and negative in estimations (5) and (6). We expected a coefficient with a positive sign. Does this mean that in 4-year averages, the private investment dynamics is unfavorable to the economic growth per capita? Nevertheless, this coefficient is positive in estimations (1), (2) and (3), but is insignificant.

The coefficient of openness trade is significant and negative in estimations (1), (2), (5), (6) and (8). This coefficient is positive in estimations (3) and (4) but is insignificant. The coefficient of openness trade can be positive or negative because of the ambiguities underlined previously of the relationship between openness trade and economic growth.

The coefficient of the dependence ratio is significant and negative in estimations (1)-(4) but positive and significant in the estimation (5). The increasing of the dependence ratio must have a negative effect on the growth rate per capita.

The coefficient of labor force growth rate is insignificant but with a positive sign.

The coefficient of government expenditures is positive and significant in estimation (7) and suggests that public expenditures dynamics is favorable to GDP per capita growth confirming the results of Devarajan, Swaroop and Zou (1996) which found a positive effect. In return, this coefficient is negative and insignificant in estimations (3) and (4). It needs to remind that in the framework of WAEMU, Nubupko (2007) and Tenou (1999) found a negative relationship using annual series. The results apparently contradictory on the annual data and the 4-year averages of our estimations confirm the ambivalence of the public expenditures effects on economic growth per capita.

The coefficient of saving is significant and positive in the estimations (3) and (4) in accordance with the waits. However, this coefficient is respectively positive and negative in estimations (7) and (8) and, insignificant.

The coefficient of inflation is significant and with a positive sign in the estimation (4). In the same way, this coefficient is positive but insignificant in the estimation (8). This suggests that an

increase of inflation is favorable to economic growth per capita. Indeed, some empirical studies have work on the inflation threshold effect. Thus, Sarel (1996) quoted by Nubukpo (2007) showed, with a sample from 87 countries with different levels of development, that inflation exert a negative effect on GDP when it is upper or equalize to 8 %.

The coefficient of the logarithm of initial income is significant and negative in estimations (5) and (6). The negative sign of the coefficient of initial income be indicative of economies conditional convergence. One must be expected to the same initial income level in the beginning of each period.

Finally, the coefficient of the lagged endogenous variable is positive in all our estimations. However, it is significant only in the estimation (5). This coefficient indeed is the parameter in equation (3).

The estimation of the dynamic panel by Arellano and bound (1991) method gives the value of the coefficient of GDP per capita growth rate. But, it needs to calculate the value of coefficient $\alpha - 1$ in the growth model. It also needs to calculate the *t-student* of coefficient $\alpha - 1$ which is equal to α / σ_{α} . Thus, table 2 of appendix B gives the values of all our estimations. It appears that this coefficient is negative and 1% significant in all our estimations.

We used different approaches to analyze the stability and the robustness of our results. Indeed, the hypothesis of non autocorrelation in the regression model of the errors terms is essential so that the GMM estimator is efficient. Arellano and Bond (1991) proposed a test which allows verifying the absence of first and second order autocorrelation. Thus, if there is absence of autocorrelation in the distribution of errors terms, this test gives a negative and significant value of the differentiated residues in the first order and non significant in the second order. This test which is based on auto-covariance standardized average residues follows a normal law (N (0,1)) under the null hypothesis. By another way, the authors proposed the instruments validity test of Sargent. Thus, if the weighting matrix is optimally selected for a given instrument matrix, Sargent test statistics follows asymptotically a law of χ^2 under the null hypothesis of validities instruments. Hansen tests (p = 1.00) and the second order autocorrelation tests of Arellano and Bond in general, do not allow rejecting the hypothesis of the validity of lagged variables in level and in differences as instrument, and the hypothesis non autocorrelation in second order (See table 3 of appendix B). In general, the results of our estimations are robust to eliminate rigorously all bias due to the non observed individual heterogeneity and offer, consequently, a better efficiency of our estimations results. In the same way, the coefficients are relatively stable through the different specifications.

6. Conclusion

In this study, we analyzed the impact of taxation on economic growth of WAEMU countries. The particularity of this study is the using of GMM in dynamic panel of Arellano and Bond (1991) to analyze the relationship between taxation and economic growth. Concretely, we evaluate the impact of fiscal returns ratio on the prosperity that is-to-say on the growth rate per capita. The results are obtained from two specifications of our model. The first estimated the model on panel data where the variables correspond simultaneously to *individual i* (country) at *time period t* (year). The second specification estimated the model always on panel data where the variables correspond simultaneously to *individual i* (country) at *time period t* which is now 4-year averages of the annual data. Thus, the data are 4-year averages over the period 1989-2012 (6 under periods of four years). The relationship between taxation and economic growth of WAEMU is positive and linear. Therefore, high and weak levels of taxation are favorable to economic growth. The WAEMU countries governments must not be concerned when they have committed in the expansionist fiscal policies. Though the WAEMU macroeconomic convergence criterions have defined a minimal level of fiscal pressure (17%) for all the Union countries and that besides much countries have not still reaches. According to the finding of this study, it would be beneficial for governments of the Union to achieve this minimal level to increase their fiscal revenue without a blow to economic growth. This conclusion is relative and may be change because of the numerous dummy variables we have included in our estimations.

7. Appendixes

Appendix A: GMM estimator in system of dynamic panel

GMM estimator in system associates equation in difference with equation in level. The equation in first difference (equation 3) is estimated simultaneously with equation in level (equation 2) by GMM. In equation in level, the variables are instrumented by their first differences. At this level, only the more recent first difference is used, the using of other lagged firsts differences result in redundancy of the conditions of moments (Arellano and Bover, 1995). Blundell and Bond (1998) tested this method with the simulations of Monte Carlo. These authors found that the GMM estimator in system is more efficient than the GMM estimator in differences. The latter produces the biased coefficients for the small samples. The bias is as much more important than the variables are persistent in time, the specific effects are important and the temporal dimension of the panel is weak.

For equation in level, one uses additional conditions of moments supposing that the explanatory variables are stationary.

$$\mathbb{E}\left[\left(y_{it-\tau} - y_{it-\tau-1}\right)\cdot\left(\mu_i + \varepsilon_{it}\right)\right] = 0 \quad \text{for} \quad \tau = 1 \tag{7}$$

$$\mathbb{E}\left[\left(x_{it-\tau} - x_{it-\tau-1}\right)\cdot\left(\mu_i + \varepsilon_{it}\right)\right] = 0 \quad \text{for} \quad \tau = 1 \tag{8}$$

$$\mathbb{E}\left[\left(z_{it-\tau} - z_{it-\tau-1}\right)\cdot\left(\mu_i + \varepsilon_{it}\right)\right] = 0 \quad \text{for} \quad \tau = 1 \tag{9}$$

The conditions of moments above (equations 4 to 9) associate with GMM allow estimating the model coefficients. To test the validity of the lagged variables as instruments, Arellano and Bond (1991), Arellano and Bover (1995), and Blundel and Bond (1998) suggest the over identified test of Sargent/Hansen. By construction, the error term in first difference is correlated with first order, but it must not been to the second order. To test this hypothesis, these same authors suggest a second order autocorrelation test.

Appendix B : Tables

Table 1: Estimation of taxation impact on economic growth per capita

	(1) Annual	(2) Annual	(3) Annual	(4) Annual	(5) 4-year averages	(6) 4-year averages	(7) 4-year averages	(8) 4-year averages
txcroispibpt-1	0.103	0.081	0.139	0.032	0.312	0.215	0.100	0.066
	(1.05)	(0.90)	(1.43)	(0.45)	(3.28)**	(1.17)	(0.62)	(0.21)
revtax	0.531	0.858	0.602	1.057	0.568	1.153	0.690	1.425
	(2.66)**	(2.39)**	(1.52)	(1.63)	(3.99)***	(2.39)**	(0.96)	(1.25)
revtaxsq		-0.010	-0.010	-0.014		-0.021	-0.013	-0.013
		(1.99)*	(1.56)	(1.49)		(1.66)	(0.41)	(0.62)
invpri	0.163	0.166	0.011	-0.055	-0.200	-0.218	-0.091	-0.202
	(1.54)	(1.47)	(0.08)	(0.29)	(2.31)**	(1.95)*	(0.64)	(1.12)
ouvcom	-0.041	-0.010	0.023	0.005	-0.034	-0.023	-0.058	-0.097
	(2.68)**	(2.15)*	(0.37)	(0.06)	(2.69)**	(1.90)*	(1.22)	(2.69)**
depop	-0.124	-0.214	-0.193	-0.258	0.184	0.153	-0.084	0.019
	(2.39)**	(2.65)**	(2.31)**	(2.38)**	(2.01)*	(1.23)	(0.68)	(0.06)
txcroisft	0.137	0.104	0.115	0.056	0.518	0.398	0.369	0.694
	(0.79)	(0.68)	(0.64)	(0.33)	(1.66)	(1.04)	(0.74)	(1.27)
dpgov			-0.016	-0.033			0.058	0.013
			(0.29)	(0.52)			(2.40)**	(0.33)
epnat			0.363	0.297			0.036	-0.100
			(2.28)*	(2.00)*			(0.60)	(0.61)
infl				0.144				0.166
				(3.10)**				(1.51)
lrevintpt					-2.420	-2.883		-1.978
					(3.15)**	(2.73)**		(0.47)
*dumtp*1	1.206	2.620	1.348	3.309				
	(1.30)	(2.44)**	(0.82)	(2.99)**				
*dumtp*2					-3.432	-2.716	-3.746	
					(3.93)***	(2.72)**	(3.23)**	
*dumtp*3	11.041	12.063	10.954	12.483	4.722	4.816	3.874	6.615
	(7.81)***	(10.8)***	(4.90)***	(6.54)***	(6.31)***	(6.45)***	(3.14)**	(5.81)***
*dumtp*4					-3.835	-3.760	-3.848	
					(3.59)***	(2.79)**	(3.56)***	
*dumtp*5					-4.440	-5.182	-3.311	
					(8.18)***	(6.67)***	(3.39)***	
*dumtp*6	12.951							
	(2.97)**							
dumdev	2.137	1.891	0.281	-1.990				
	(0.70)	(0.64)	(0.10)	(0.96)				
*dumbur*91	8.134	8.754	7.912	7.974				
	(13.9)***	(15.1)***	(11.7)***	(16.6)***				
*dumcd*98	1.568	1.135	-0.646	-1.235				
	(2.66)**	(1.36)	(0.45)	(0.63)				
*dumcd*10	-4.953	-6.764	-10.889	-10.789				
	(7.42)***	(6.13)***	(2.45)**	(2.03)*				
*dumma*92	4.922	5.560	5.474	6.368				
	(4.98)***	(6.51)***	(4.07)***	(5.15)***				
*dumnig*92	-9.197	-8.125	-9.776	-7.689				
	(5.63)***	(5.70)***	(4.34)***	(7.97)***				
*dumsen*99	1.653	1.642	1.067	1.325				
	(10.0)***	(6.98)***	(1.70)	(2.33)**				
*dumtg*91	-2.610	-3.007	-2.669	-1.430				
	(1.41)	(1.88)*	(1.67)	(1.35)				
F statistic	106.03	20.15	11.76	7.41	139.21	123.89	132.71	257.15
Observations	191	191	191	191	47	47	47	47

Significant levels: *** $p<0.01$; ** $p<0.05$; * $p<0.1$. Robust standards errors are in the brackets.

Table 2: **Calculation of coefficients values of the lagged endogenous variable in the growth model ($\alpha - 1$)**

Estimations	Coef.	Std. Err.	t	P>|t|
(1)	-0.897	0.097	-9.18	0.000
(2)	-0.918	0.089	-10.22	0.000
(3)	-0.860	0.097	-8.85	0.000
(4)	-0.968	0.071	-13.57	0.000
(5)	-0.688	0.095	-7.23	0.000
(6)	-0.784	0.184	-4.26	0.003
(7)	-0.900	0.161	-5.56	0.001
(8)	-0.934	0.315	-2.97	0.018

Source : Author, based on the estimations.

Table 3: **Robustness tests of the estimations**

	Obs.	Test on AR(1)	Test on AR(2)	Sargent test	Hansen test
(1)	191	Z=-1.84 [0.06]	Z=-0.82 [0.41]	chi2(8)=13.36 [0.10]	chi2(8)=0.00 [1.00]
(2)	191	Z=-2.02 [0.04]	Z=-0.86 [0.39]	chi2(9)=13.74 [0.13]	chi2(9)=0.00 [1.00]
(3)	191	Z=-2.00 [0.04]	Z=-1.23 [0.22]	chi2(9)=13.14 [0.15]	chi2(9)=0.00 [1.00]
(4)	191	Z=-2.24 [0.02]	Z=-0.45 [0.65]	chi2(10)=18.3 [0.05]	chi2(10)=0.00 [1.00]
(5)	47	Z=-1.19 [0.23]	Z=-1.55 [0.12]	chi2(7)=15.0 [0.03]	chi2(7)=0.00 [1.00]
(6)	47	Z=-1.40 [0.16]	Z=-1.30 [0.19]	chi2(8)=16.7 [0.03]	chi2(8)=0.00 [1.00]
(7)	47	Z=-1.24 [0.21]	Z=-1.28 [0.20]	chi2(9)=22.9 [0.00]	chi2(9)=0.00 [1.00]
(8)	47	Z=-2.00 [0.04]	Z=-1.78 [0.07]	chi2(11)=20.6 [0.3]	chi2(11)=0.00 [1.00]

Source : Author, based on the estimations.

Table 4: **Unit root test on panel data (annual)**

Series	IPS				LLC			
	Test	*vc*	*p-val*	*Or. Int*	*Test*	*vc*	*p-val*	*Or. Int*
txcroispibpt	-5.162	-2.620	0.000	I(0)	-15.808	-10.114	0.0000	I(0)
revtax	-2.389	-1.990	0.003	I(0)	-7.141	-3.0472	0.0012	I(0)
invpri	-3.466	-2.620	0.000	I(0)	-9.160	-5.4240	0.0000	I(0)
ouvcom	-5.298	-2.620	0.000	I(0)	-16.300	-11.165	0.0000	I(0)
depop	0.595	-1.990	1.000	I(1)	-3.742	0.2590	0.6022	I(1)
txcroisft	-2.857	-2.620	0.010	I(0)	-7.907	-2.8588	0.0021	I(0)
dpgov	-13.115	-2.620	0.000	I(0)	-39.756	-33.617	0.0000	I(0)
epnat	-2.810	-2.620	0.016	I(0)	-8.166	-3.8098	0.0001	I(0)
infl	-4.313	-2.620	0.000	I(0)	-12.922	-8.6718	0.0000	I(0)

Source : Author, based on the World Data Indicator and the Statistics of BCEAO.

Table 5: **Unit root test on panel data (4-year averages)**

Series	IPS				LLC			
	Test	*vc*	*p-val*	*Or. Int*	*Test*	*vc*	*p-val*	*Or. Int*
txcroispibpt	-2.131	-2.060	0.043	I(0)	-7.580	-3.6519	0.0001	I(0)
revtax	-4.856	-2.740	0.000	I(0)	-15.964	-14.697	0.0000	I(0)
invpri	-1.289	-2.060	0.722	I(1)	-3.511	-2.2561	0.0120	I(0)
ouvcom	-5.732	-2.740	0.000	I(0)	-25.769	-23.998	0.0000	I(0)
depop	-2.802	-2.740	0.046	I(0)	-17.274	-16.079	0.0000	I(0)
txcroisft	-2.582	-2.740	0.135	I(1)	-11.039	-8.5523	0.0000	I(0)
dpgov	-18.16	-2.740	0.000	I(0)	-59.702	-58.178	0.0000	I(0)
epnat	-1.766	-2.060	0.237	I(1)	-4.846	-2.5117	0.0060	I(0)
infl	-4.011	-2.740	0.000	I(0)	-20.630	-19.139	0.0000	I(0)
lrevintpt	-2.717	-2.740	0.072	I(0)	-10.167	-8.0328	0.0000	I(0)

Source : Author, based on the World Data Indicator and the Statistics of BCEAO.

Table 6: **Variables sources**

Variable	Description	Source
GDP per capita growth rate	Annual average of GDP per capita growth rate (in %)	WDI
Income tax	Fiscal returns as share of GDP (in %)	BASTAT & WDI
Initial income per capita	Initial GDP per capita of each under period, current price (in %)	WDI
Public expendenture	Total public expenditure as a share of GDP (in %)	BASTAT & WDI
Private investissement	Private gross fixed capital formation as a share of GDP (in %)	BASTAT
Dependance ratio	Population aged 0-14 and >65 as a share of total population (in %)	WDI
Openness trade	Export et import as a share of GDP (in %)	BASTAT & WDI
Labor force growth rate	Annual average of labor force (in %)	WDI
National saving	Domestic saving as a share of GDP (in %)	WDI
Inflation	Annual inflation (en %)	WDI

WDI : World Data Indicator. BASTAT : Statistics of BCEAO

Tableau 7: **Variables descriptions**

Variable	Obs.	Mean	Std. Dev.	Min	Max	Description
GDP per capita growth rate	48	0.500	2.09	-6.32	3.31	Annual average of GDP per capita growth rate (in %)
Income tax	48	13.20	4.61	5.84	27.62	Fiscal returns as share of GDP (in %)
Initial income per capita	48	5.23	0.331	3.74	5.74	Initial GDP per capita of each under period, current price (in %)
Public expendenture	48	28.80	39.53	15.16	293.2	Total public expendenture as a share of GDP (in %)
Private investissement	48	10.58	5.34	1.43	29.94	Private gross fixed capital formation as a share of GDP (in %)
Dependance ratio	48	48.16	2.00	44.75	52.44	Population aged 0-14 and >65 as a share of total population (in %)
Openness trade	48	69.37	45.70	31.65	331.8	Export et import as a share of GDP (in %)
Labor force growth rate	48	2.44	1.17	0.46	4.62	Annual average of labor force (in %)
National saving	48	7.04	7.55	-13.4	21.81	Domestic saving as a share of GDP (in %)
Inflation	48	5.85	10.48	-3.97	60.24	Annual inflation (en %)

Appendix C : Figures

Figure 1: Fiscal and non fiscal returns ratio as a share of the total returns of the WAEMU

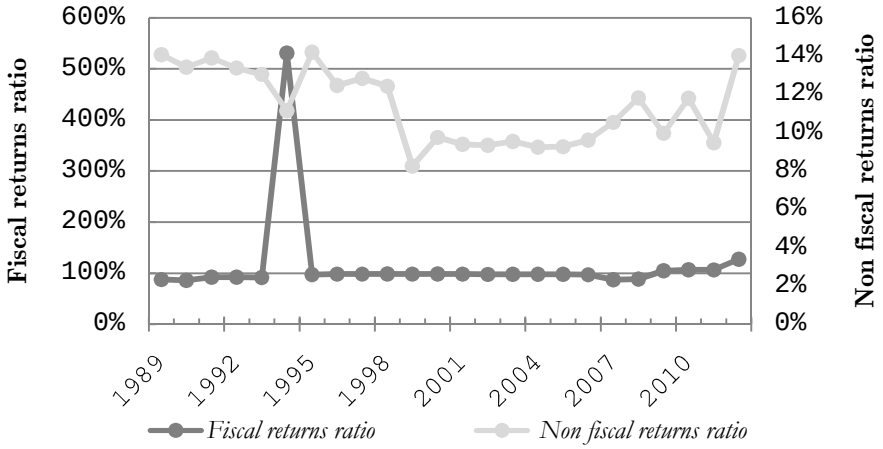


Figure 2: GDP per capita growth rate and fiscal returns ratio of Benin

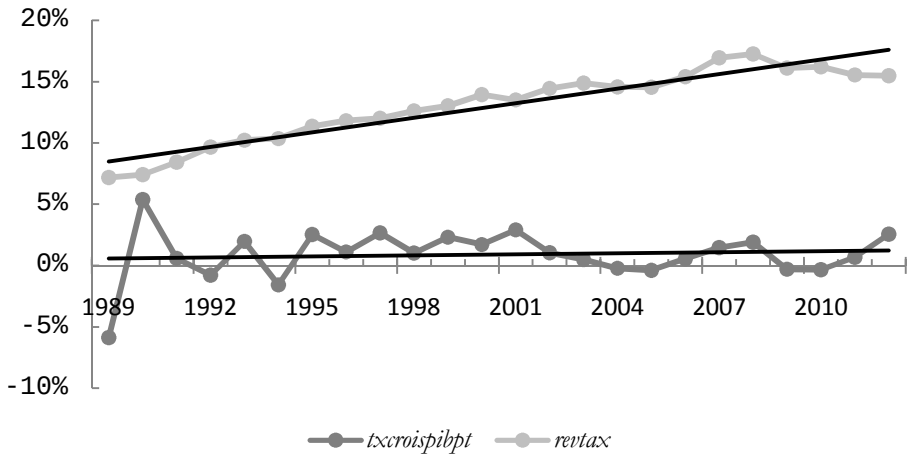


Figure 3: GDP per capita growth rate and fiscal returns ratio of Burkina Faso

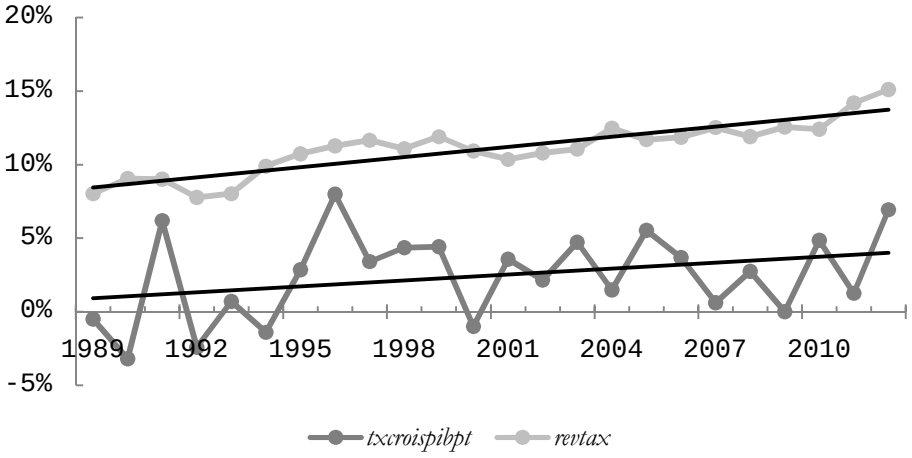


Figure 4: GDP per capita growth rate and fiscal returns ratio of Ivoiry Coast

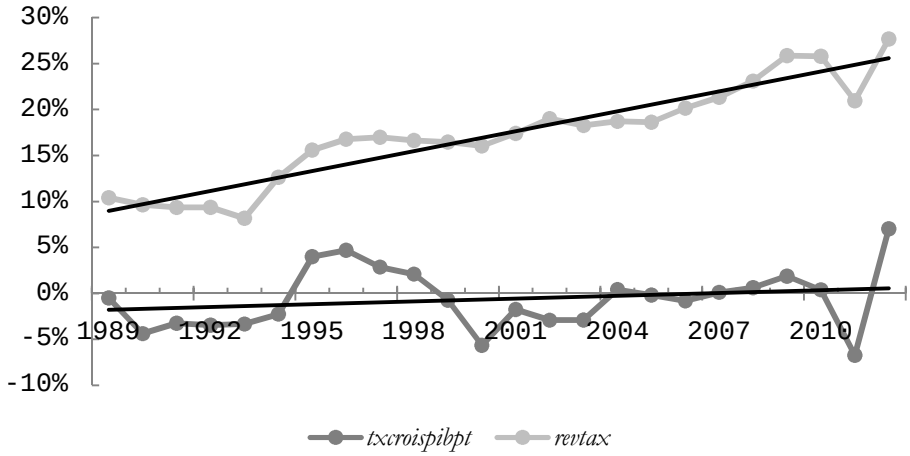


Figure 5: GDP per capita growth rate and fiscal returns ratio of Guinea Bissau

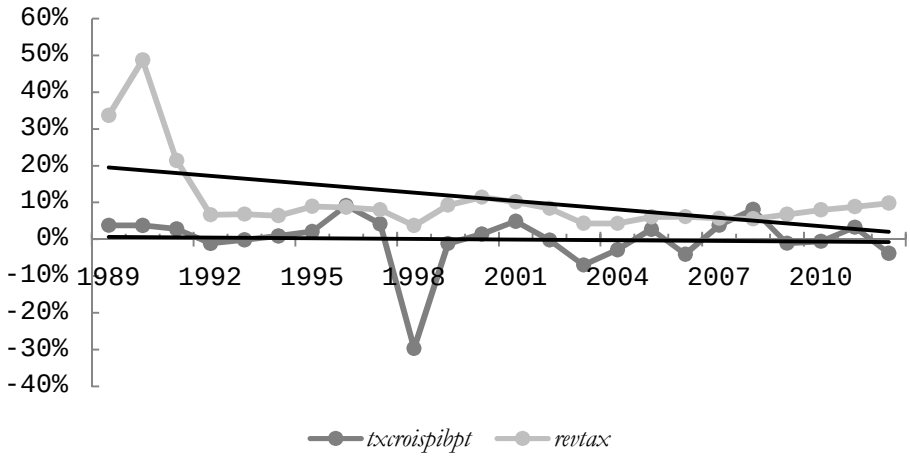


Figure 6: GDP per capita growth rate and fiscal returns ratio of Mali

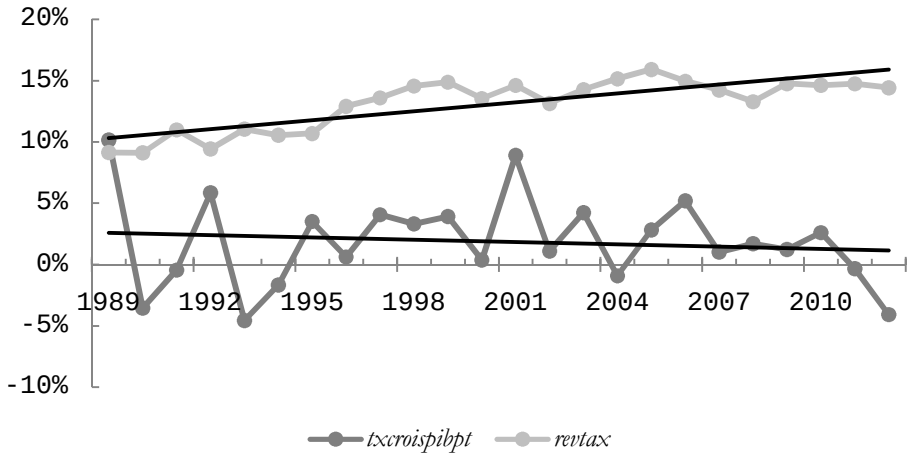


Figure 7: GDP per capita growth rate and fiscal returns ratio of Niger

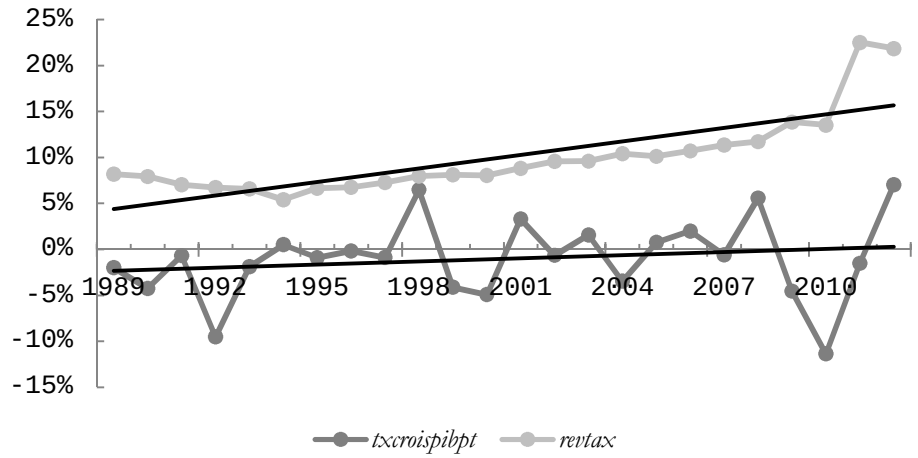


Figure 8: GDP per capita growth rate and fiscal returns ratio of Senegal

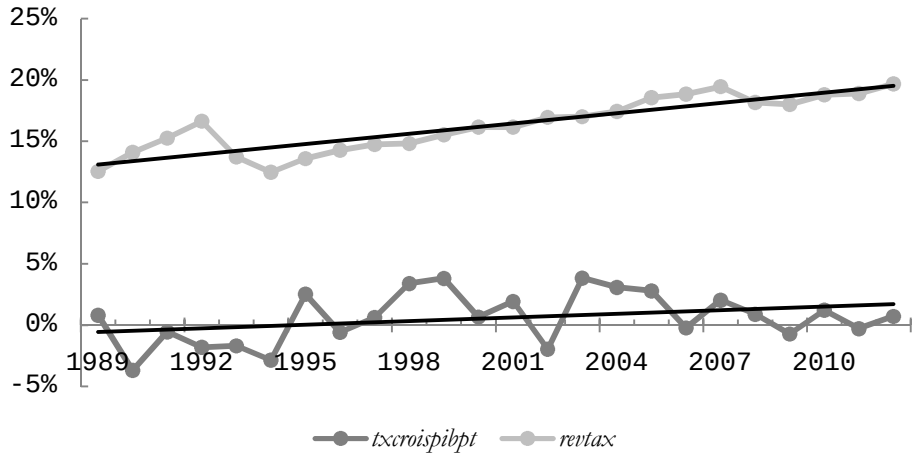
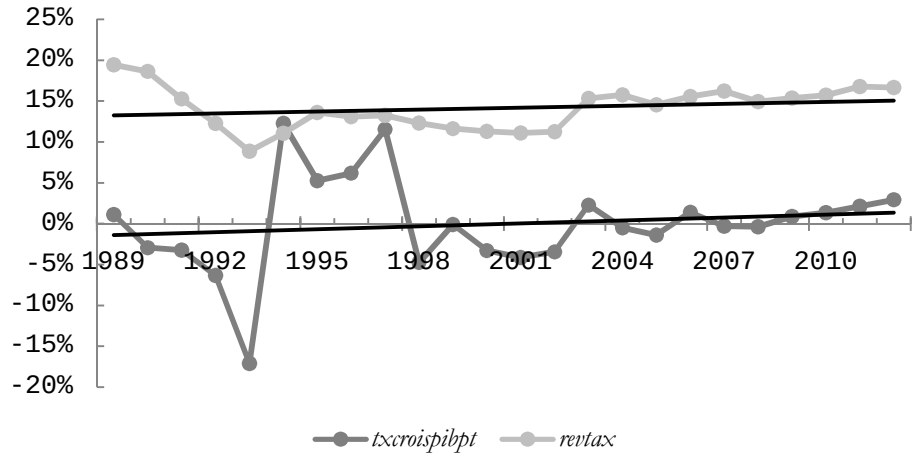


Figure 9: GDP per capita growth rate and fiscal returns ratio of Togo



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