Journal of Economics and International Finance Vol. 2(9), pp. 164-174, September, 2010
Available online at http://www.academicjournals.org/JEIF
ISSN 2006-9812 ©2010 Academic Journals

Review

Estimating the growth-maximizing tax rate for Cote d'Ivoire: Evidence and implications

Yaya Keho

Ecole Nationale Supérieure de Statistique et d'Economie Appliquée (ENSEA) Abidjan-Côte d'Ivoire. 08 BP 03 Abidjan 08, Côte d'Ivoire. E-mail: yayakeho@yahoo.fr. Tel: (225) 22 44 41 24. Fax: (225) 22 48 51 68.

Accepted 7 July, 2010

This paper investigates the optimal tax burden for the Ivorian economy. To address this issue, the empirical analysis was conducted using both Scully and quadratic regression models and annual data covering the period from 1960 to 2006. These models suggest that the growth-maximizing tax rate is in the range of 21.1 to 22.3% of GDP. At that tax rate, the economic growth rate would be around 6.2% instead of the actual 3.2%. The actual low tax rates are shown to be responsible for substantial losses in growth and tax revenues.

Key words: Tax rate, economic growth, government revenue.

INTRODUCTION

Today, economists increasingly recognize that a minimal level of government size is necessary for social and economic progress. The three main fiscal functions of government are to provide public goods and services such as national defense, law and order, infrastructure and public health, to promote equity through income redistribution, and to contribute to stabilizing the economy (Musgrave, 1959). Without the first function of government, it is easy to see that there would be little economic activity. Without adequate protection for property rights and a secure political environment, individuals and firms will face severe disincentives to invest and engage in productive activities. The contribution of certain types of public spending to the long-term economic growth rate has been emphasized by recent endogenous growth models. More recent research conducted by the World Bank concluded that the lack of infrastructures impedes economic growth and social development in many African countries (World Bank, 1994). By providing infrastructure and an educated and healthy work force, government expenditures make private economic activity more productive.

Recognising the growth effects of public spending, Ivorian government has undertaken over the past three decades a number of structural reforms in its tax system aiming at increasing tax revenues. These reforms have been intensified from 1994 to 2005. Some of these reforms intend to extend the tax base and reduce exemptions while administrative reforms intend to improve the collecting system by decentralizing the fiscal administration, eliminating fraud, evasion and corruption[1]. Despite these reforms, the overall tax rate shows a downward trend, declining from 21% in 1965 to 17% in 1990 and 16% from 1998 to 2008. These performances do not meet the convergence criteria that target a level of tax revenues exceeding 17% of GDP[2]. In the eyes of some observers, Ivorian economy can record more than 21% as tax rate.

This claim raises a number of important issues. Is growth affected by taxation? How low can tax rate be? Can government, through appropriate tax policy, trigger a spurt of growth? At what level of taxation the rate of growth decreases? Is there nonlinearity in the tax- growth nexus? Is it possible to determine the optimal tax rate

JEL classification: C13, E62, H21

[1] An overview of a chronology of fiscal reforms implemented in Côte d'Ivoire from 1960 to 2005 can be found in "*Code Général des Impôts, Livre de procedures fiscales, Autres textes fiscaux, 2007*", Direction Générale des Impôts, Côte d'Ivoire.

[2] Côte d'Ivoire is member of the West African Economic and Monetary Union (UEMOA). This union has adopted in 1994 convergence criteria aiming at explicit targets for inflation, public debt and deficits to monitor the fiscal situation of the member countries. To meet the convergence criteria, the member countries should, among others, increase tax revenues over 17% of GDP and keep public deficit at a minimum of zero percent of GDP.

that would maximize the economic growth rate? What would be the costs, on both the level and the rate of growth of real GDP, of higher or lower tax rates? The objective of this paper is to provide answers to the latter questions and see whether the minimum level of 17% makes any sense from the growth point of view. More precisely, we try to find the optimal tax rate for Côte d'Ivoire using data from 1960 to 2006. We then quantify the current cost of maintaining the existing tax rate, or the potential benefit to be gained by adopting the growth-maximizing tax rate. Although our analysis looks only at the link to growth, it is of course important to acknowledge that economic growth may not be the only objective of tax policy design.

The remainder of this paper is organized in the following manner. Section 2 reviews the related literature on the effect of taxes on economic growth. Section 3 outlines the econometric models used to derive the optimal tax rate and simulate the costs of actual tax rates. The estimation results are presented and discussed in Section 4. In Section 5 we quantify the costs of the existing tax performance. Section 6 concludes and delineates some topics for further research.

TAXATION AND ECONOMIC GROWTH: A REVIEW

Theoretical issues

Economists have long questioned the effect of taxes on economic growth. There are those who have long argued that taxes had little impact on growth, while policymakers aggressively pursued development by using tax incentives. Advocates of tax cuts claim that a reduction in the tax rate will lead to increased economic growth and prosperity. More recent research in the field of public finance has begun to show that high levels of taxation inhibit economic growth, and the emerging consensus among economists now says that tax rates matter for economic growth. The idea that tax policies matter is most closely associated with supply-side economics in late 1970s[3] and the work of Arthur Laffer who illustrated that there is an optimal level of taxation for a given economy.

Since Laffer, politicians and economists have been warned that excessive taxation is costly to government in terms of growth and tax revenue. Government tax revenue does not necessarily increase as tax rate increases because taxable income changes when tax rates are altered. The government will earn more tax income at 1% rate than at 0%, but it will not earn more at 80% than it will at 10%. The reasons of these losses in tax revenue are explained by Laffer (1981). Higher tax rates imply more tax evasion and avoidance. The more people avoid or evade taxes, the less revenue the government will collect per unit of the taxable base and the more money it will have to spend to monitor and enforce tax codes. Conversely, lower tax rates may be expected to reduce tax evasion and avoidance. This means that there is a peak tax rate where government tax revenue is highest. This parabolic relationship between tax rate and tax revenue has been graphed on something called a "Laffer curve". The empirical underpinning of this curve is not new. Economists have long recognized that high levels of taxation may have adverse consequences for individual economic incentives and economic growth. In his "Inquiry into the Nature and Causes of the Wealth of Nations", Adam Smith (1776) expounded some basic principles of taxation. He had observed that raising import tax rates beyond a certain level discouraged compliance, encouraged smuggling and, therefore, lowered tax revenues. Smith believed that taxes should be designed so as to minimize taxpayers' compliance costs and government's administrative cost, while also discouraging tax avoidance and evasion. Smith's wisdom regarding the macroeconomic effects of taxation continues to elude some economists. In recent years, a number of economists have investigated the relationship between the tax rate and the rate of economic growth. They found a similar "Laffer curve" in this relationship, suggesting that, up to some level, fiscal policy is growth promoting, but beyond this level increased taxation has a negative externality on the economic activity. Figure 1 depicts the pattern of the relationship between taxation and economic growth; where τ^* is the growth-maximizing tax rate and g^* is the optimal growth rate of the economy under a regime of a constant tax rate of τ^*. Up to the level τ^*, the provision of public goods and services makes private economic activity more productive. Thus, increases in government taxation up to τ^* increase the rate growth rate at a decreasing rate. At a tax rate equal to τ^*, the growth rate is at its maximum. On the contrary, beyond the level τ^*, taxes tend to slow the growth rate at an increasing rate, producing large deadweight losses.

How do the effects of taxation on growth come to be negative? At first glance, it is not apparent that higher taxes should harm economic growth. A tax increase would simply move the spending decision from the private sector to the public sector. It does not matter who has the control of economic resources. The main thing that matters is that there would be sufficient total demand to prevent recessions. However, this analysis of taxation appears to be very narrow. It ignores the fundamental axiom of taxation which indicates that taxing an activity will reduce the level of that activity. So the primary burden of tax is a decrease in economic activity, referred to as deadweight loss. For example, raising the taxes on wheat will reduce bred consumption. Raising the taxes on cars will reduce car ownership.

In neo-classical growth models, fiscal variables such

[3] Laffer (1981) provided an overview of supply-side theory.

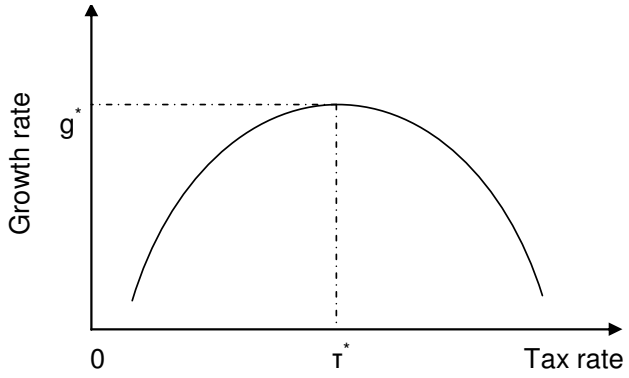

Figure 1. Illustration of the effect of the positive-negative externality pattern of taxation on economic growth à la Barro (1990).

taxes and public spending can affect long-run output levels but not the long-run output growth (Judd, 1985; Chamley, 1986). The steady-state output growth is determined by exogenous factors such as population growth and technological progress, while fiscal policy can affect only the transition path of this steady-state. By contrast, in endogenous growth models, fiscal policy can affect both the level of output and the steady-state growth rate (Lucas, 1988; Barro, 1990; Stokey and Rebelo, 1995; Mendoza et al., 1997). The development of endogenous growth theory has opened an avenue through which these growth effects can be explored. These models tell us that if taxes are used to fund investment in public goods, especially goods resulting in external benefits (infrastructure, education and public health), the economic growth rate could be positively influenced by taxation. However, taxes can have many distortionary effects on growth (Engen and Skinner, 1996; Mendoza et al., 1997; Myles, 2000). First, higher taxes affect the stock of physical capital directly by discouraging investment and lowering the investment rate. If taxes on the earnings of capital rise too high, then the owners of capital will charge higher prices for the use their capital. The usual result from this situation will be greater use of human labor to do the work that machines previously performed. People lose access to new and labor-saving technologies. Consequently, productivity of labor falls, which reduces the rate of economic growth. Second, it is well known that education makes labor force more productive and leads to economic prosperity. High taxes may attenuate labor supply growth by discouraging labor force participation or hours of work, or by distorting occupational choice or the acquisition of education, skills, and training. Third, tax policy can also influence productivity through various channels (Schwellnus and Arnold, 2008). Theory of public finance suggests that taxes create distortions by affecting prices and the decision making of agents. These distortions result in reallocation of inputs within and between firms that could have transitional effects on growth (Auerbach and Hines, 2002). For instance, a change in the relative factor price could lead to less usage of one of the production inputs in a firm. Inputs not used in this firm are either re-allocated to other less productive firms or not used at all, thereby lowering the efficiency in the use of production inputs. Vartia (2008) highlights three specific channels through which taxation affect productivity, namely distortions in factor prices and factor allocation, entrepreneurship and research and development activity. High corporate taxes reduce the firms' incentives to invest in technology and other productivity-enhancing innovations by reducing the potential profits generated by those investments. As a result, productivity is reduced in the formal sector, hurting the overall long-term economic growth. High corporate taxes reduce incentives for risk taking by firms with negative consequences for productivity. As shown by Zilcha and Eldor (2004), corporate tax schedules in most countries are characterised by an asymmetric treatment of profits and losses: profits are taxed at a higher rate than losses are compensated. In such a context, firms pay the statutory corporate tax rate in the event that the risky project is successful, but is only partly compensated in the event that it is unsuccessful. Corporate taxes and taxes incentives have the potential to discourage productivity growth by attenuating research and development (R&D) activities whose spillover effects can potentially enhance the productivity of existing production factors. Here, the idea is based on the theory of the user cost of capital and assumes that firms maximise their profits and invest in R&D until the marginal product of that activity is equal to its marginal cost, measured as the user cost of R&D (Hall and Van Reenen, 2000). The empirical literature provides some evidence supporting the user cost approach with a long-run user cost elasticity of R&D close to minus one (Bloom et al., 2002; Jaumotte and Pain, 2005). Finally, high tax rates can discourage investment in sectors with high productivity but heavily taxed, and direct it toward more lightly taxed sectors with lower overall productivity. It has been shown that there is a positive relationship between taxes and the size of the underground economy[4].

Empirical review

On the empirical ground, a number of studies have tried

[4] Garagata and Giles (1998) analyse the relationship the relative size of the Hidden Economy in New Zealand and the effective tax rates for the major tax components. They find that for every percentage point reduction in the tax/GDP ratio, the Hidden Economy/GDP ratio drops by about 0.2 % points. They also find that the Hidden Economy/GDP ratio is very responsive to changes in the tax "mix" in favour of relatively more indirect taxation, and that at an effective tax rate of about 21% of GDP, the impact of tax changes on underground activity begins to decelerate. (Kesselman, 1989; Trandel and Snow, 1999).

to analyse the link between taxes and growth. Results vary across countries, methodologies, fiscal variables involved as well as across time periods within the same country. Engen and Skinner (1996), Arnold (2008) and Myles (2000) provide surveys on this literature. The influential work by Barro (1990), using a data set covering a large cross-section of both rich and poor countries, presents strong empirical evidence favoring the view that higher taxes are growth-impeding. This result has been confirmed in some subsequent studies, but has been challenged in others. For example, studies such as Engen and Skinner (1992), Kormendi and Meguire (1995), Cashin (1995) and Engen and Skinner (1996) find evidence showing that economic growth is retarded by taxation[5]. Others such as Katz et al. (1983), Koester and Kormendi (1989), Slemrod (1995) and Mendoza et al. (1997) do not detect any significant effect of taxation on economic growth. In their study, Easterly and Rebelo (1993) conclude that the evidence that tax rates matter for growth is fragile. Levine and Renelt (1992) and Agell et al. (1997) also fail to find a robust cross-country link between a variety of fiscal policy indicators and long-run growth rates.

The finding that the aggregate tax rate has no significant impact on economic growth probably arises from the two opposing effects of taxes. On the one hand, the negative effect arises from the distortions to choice and disincentive effects. This holds in particular when taxes are used for transfer payments. On the other hand, if the collected taxes are used to fund investment in public goods, the economic growth rate could be positively influenced by taxation. The negative effect of taxation is then offset by the positive production effect of higher spending on public services (Helms, 1985). There is evidence (Engen and Skinner, 1992; Easterly and Rebelo, 1993, Keho, 2009) that tax rates are strongly correlated with public spending. Since some kinds of public expenditure are growth enhancing, the coefficient on tax rates captures both the negative impact of taxation and the positive effect of public spending on growth, and by that turns out to be statistically insignificant.

A number of empirical works look at the effects of different types of taxes on growth, arguing that what matters for growth is not only the level of taxes but also the way in which different tax instruments are designed and combined to generate revenues. Skinner (1987) analyses the effect of taxation in sub-Saharan Africa over the period 1965 - 1982. He finds that taxes levied on personal and corporate income reduce economic growth, while sales and excise taxes have no significant effect on economic growth. Wang and Yip (1992) show that the structure of taxation is more important than the level of tax rate in explaining economic growth in Taiwan from 1954 - 1986. They find significant and negative impacts of specific taxes on economic growth, but the effect of total taxation is not significant. Widmalm (2001) uses cross-section data of 23 OECD countries over the period 1965 - 1990, and finds that the share of total taxes levied on personal income has negative effect on economic growth, while consumption taxes tend to be growth enhancing.

Results obtained by Arnold (2008) from 21 OECD countries over the period 1970 - 2005 suggest that income taxes are associated with significantly lower economic growth rates than taxes on consumption and property. Vartia (2008) analyses the effects of tax policies on investment and productivity for a set of OECD countries using industry-level data. He finds that both corporate and personal income taxes have a negative effect on productivity. These effects are stronger in industries that are more profitable. Similar findings are reported by Schwellnus and Arnold (2008). They show that corporate taxes reduce investment through an increase in the user cost of capital.

A common limitation of most of the empirical studies of taxation and growth is that they are based on linear models in which taxes enter the growth rate equations in a linear fashion. They do not account for the nonlinearity in the tax-growth relationship as suggested by Barro (1990). Consequently, they fail to derive any optimal level of tax rate beyond which taxes are growth retarding. Another strand of the public finance literature has investigated this topic. The main purpose of this empirical literature was to estimate the optimal tax rate and quantify the deadweight loss of high taxes and thus the marginal cost of taxation. Scully (1996, 2000) finds evidence of the inverted-U relationship for New Zealand over the period 1927 - 1994. The tax rate that maximizes the growth rate is about 20% of GDP. This implies that for all values of the tax burden exceeding that level, taxes act as a negative externality. Using data spanning 1949 - 1989, Scully (1995) finds the optimal tax rate for the United States to be in the range of 21.5 and 22.9% of GDP. The optimal growth rate corresponding to that tax rate is about 5.56% compared to an average growth rate of 3.5%. However, when the data span is restricted to the period 1960 - 1990, the estimated growth-maximizing tax rate for the United States is 19.3% (Scully, 2003). At that tax rate, the growth rate would have been 6.97% per year. Scully also reports results for other developed countries using the same economic method applied to the US data. The sample of countries includes the United States (1929 - 1989), Denmark (1927 - 1988), United Kingdom (1927 - 1988), Italy (1927 - 1988), Sweden (1927 - 1988), Finland (1927 - 1988) and New Zealand (1927 - 1994). On the average, the optimal tax rate is about 20% ranging from 16.6% for Sweden to 25.2% for the United Kingdom. Current levels of taxation, however,

[5]Many other studies present strong evidence that taxation is negatively associated with economic growth or real GDP per capita (Fölster and Henrekson, 2001; Blanchard and Perotti, 2002; Holcombe and Lacombe, 2004; Karras and Furceri, 2009).

range from 34.1% in the United Kingdom to 51.6% in Denmark. These findings show that tax rate far above the optimal rate is common among developed countries. This has slowed the economic growth rate of these countries. Branson and Lovell (2001) used a linear programming model to estimate a growth-maximising tax structure for New Zealand over the period 1946 - 1995. They find a mean growth-maximizing tax burden of 22.5% of GDP.

As can be seen from the empirical literature, there does not exist studies on African countries devoted to estimating an optimal tax rate. Empirical works that have been conducted for these countries have been focused on the growth effects of taxes and have not investigated the existence of a U-inverted curve in the tax-growth relationship. This study attempts to contribute to the empirical literature by examining the case of Cote d'Ivoire over the period 1960 - 2006.

ECONOMETRIC MODELS

To investigate the optimal size of government taxation, we have sought to estimate a relationship between the level of taxation and the rate of economic growth over time. As we are concerned with the overall tax rate that maximizes the economic growth rate, our empirical specification should trace out the pattern depicted in Figure 1.

Discovery of such a figure will help us determine whether there exists a threshold level above which taxation lowers the rate of economic growth. To address this issue, we use two alternative models of growth-maximizing taxation: the Scully model and the quadratic regression model.

The Scully model

Scully (1996, 2003) developed a model that estimates the tax burden that maximizes real economic growth. The model relates the level of output to the overall tax as share of GDP. The economy is divided into public and private sectors. Government provides public goods and services which are financed exclusively out of taxes collected.

A balanced budget assumption is made that $G = \tau Y$, where Y is the national output and τ is the total tax rate. The share of output left for private sector, $(1-\tau)Y$, is used to produce private goods. These public and private goods are then used to produce national output following a Cobb-Douglas production function:

$$Y_t = a(G_{t-1})^b[(1-\tau_{t-1})Y_{t-1}]^c = a(\tau_{t-1}Y_{t-1})^b[(1-\tau_{t-1})Y_{t-1}]^c \quad (1)$$

where a, b and c are parameters such that $b, c < 1$.

Taking the log form yields:

$$\log(Y_t) = \log(a) + b\log(\tau_{t-1}Y_{t-1}) + c\log[(1-\tau_{t-1})Y_{t-1}] \quad (2)$$

The growth-maximizing tax rate τ_1^* is obtained by differentiation of log (Y) with respect to τ, setting the result to zero, and solving for τ:

$$\frac{\partial \log(Y)}{\partial \tau} = \frac{b}{\tau} - \frac{c}{1-\tau} \quad (3)$$

Solving for the growth-maximizing tax rate yields:

$$\tau_1^* = \frac{b}{b+c} \quad (4)$$

Thus, we use the following equation to estimate the optimum level of taxation:

$$\log(y_t) = \alpha + b\log(\tau_{t-1}y_{t-1}) + c\log[(1-\tau_{t-1})y_{t-1}] + \zeta_t \quad (5)$$

Where y_t is real GDP and ζ_t is an error term assumed to be normally distributed with zero mean and constant variance.

Kennedy (2000) and Hill (2008) point out that the Scully model may produce spurious estimates of an optimal tax rate because the production function specification ignores the contribution of earlier periods' capital goods to output. To be derived from a simple endogenous growth model, the Scully model requires that the rate of depreciation of capital goods is 100% per year, that is, capital goods are entirely used up in the process of annual production. In his reply to this criticism, Scully (2000) notes that the contribution of previously-accumulated capital and technological changes in the aggregate production function are implicitly captured by the presence of the lagged production term Y_{t-1} in the current production function. He also demonstrates that incorporating factors inputs into the model does not change the analytical results.

Quadratic model

Another way to trace out the pattern of the relationship between two variables that is theoretically characterized by the inverted U curve is to estimate a quadratic relation by including a square of the explanatory variable. Thus, to complement the Scully model, we specify that the growth rate g_t is related to the tax rate τ_t in the following manner:

$$g_t = \alpha + \beta\tau_t + \gamma\tau_t^2 + e_t \quad (6)$$

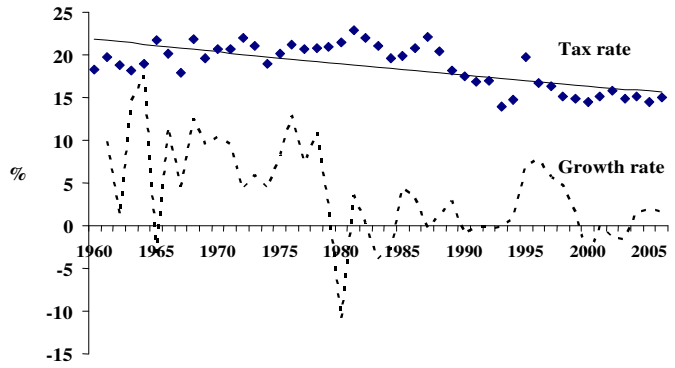

Figure 2. Economic growth and tax rate in Cote d'Ivoire over time, 1960 – 2006.

The tax rate that maximizes economic growth from this equation is found to be the following after differentiating g_t with respect to τ_t and setting the result to zero:

$$\tau_2^* = -\frac{\beta}{2\gamma} \tag{7}$$

To be the optimal tax rate, we should have $\beta > 0$ and $\gamma < 0$. The expected positive sign on τ_t is designed to show the beneficial effects of government spending on growth, while the expected negative sign for the squared term τ_t^2 captures the adverse effects associated with increased tax rates.

DATA AND ESTIMATION RESULTS

Country description and data

Before presenting the data used for analysis, we will give a brief description of the country under investigation. This will help us better understand the econometric model employed in the subsequent section of the study[6]. Côte d'Ivoire is an African country member of the West African Economic and Monetary Union (WAEMU). This organisation includes eight states of West Africa sharing a common currency (the CFA franc). After two decades (1960 - 1980) of good economic performance, Côte d'Ivoire enters a long period of economic crisis. Domestic adjustment strategies pursued during the 1980s failed to boost economic activity and to close all deficits. As a necessary response to the failure of macroeconomic policies, the country experiences together with the other members of WAEMU, the devaluation of the CFA franc on January 11, 1994. The devaluation accompanied by structural reforms led to an encouraging recovery; economic performance has strengthened significantly since 1994 and budget deficits fell. But all will change on December 24, 1999, when rebels overthrew the government in the country's first military coup. Since that time, the political agenda of Côte d'Ivoire has been dominated by political and social tensions. This situation has culminated in a war on September 19, 2002 which divided the country in two. Since 2004, however, the fighting has officially ceased and the main players in the conflict are working to find a political solution. The presidential election initially scheduled for October 2005 was postponed. It is expected to be done in 2010. The uncertainty surrounding the political agenda affects the economic outlook.

The empirical analysis uses annual data on total tax rate and real GDP over the period 1960 - 2006. The overall tax rate (τ_t) is computed as the ratio of total tax revenues to nominal GDP. Nominal data on tax revenues and GDP are gathered from the National Institute of Statistic and the statistics yearbook 2006 published by the Central Bank of West African States (BCEAO, 2006). Data for real GDP (y_t) are obtained from the 2007 world development indicators of the World Bank. The estimation used two dependent variables: the log of real GDP and the growth rate of real GDP. Additionally, several dummy variables were included to control for macroeconomic events experienced by the country.

The trends of real GDP growth and tax burden over the sample period are shown in Figure 2. The dashed line is the growth rate and the solid line the (least squares) trend line for tax rate. A notable feature from this figure is the declining trend in both tax and growth rates. From 1960 to 2006, the tax burden has fallen from the 18 to 21% range, to below 16% of GDP. The growth rate has fluctuated between 17.6% and -11%, averaging 3.8% over the period. The peak of 17.6% occurred in 1964; however, since 1999, the growth rate has remained below 2%, reflecting the adverse effects of the political crisis. The downward trend in tax rate reveals that tax revenue has grown more slowly than GDP. As such, the government tax revenue is below what would have been collected, had the tax rate been maintained over the period.

Estimation results

Estimation of Equation (5) yields the following results:

$$\log(y_t) = \underset{(8.504)}{0.901} + \underset{(4.891)}{0.214}\log(\tau_{t-1} y_{t-1}) + \underset{(19.849)}{0.746}\log[(1-\tau_{t-1})y_{t-1}] - \underset{(-3.131)}{0.048} D8094_t + \zeta_t \tag{8}$$

[6] This description also follows a suggestion from one of the referees.

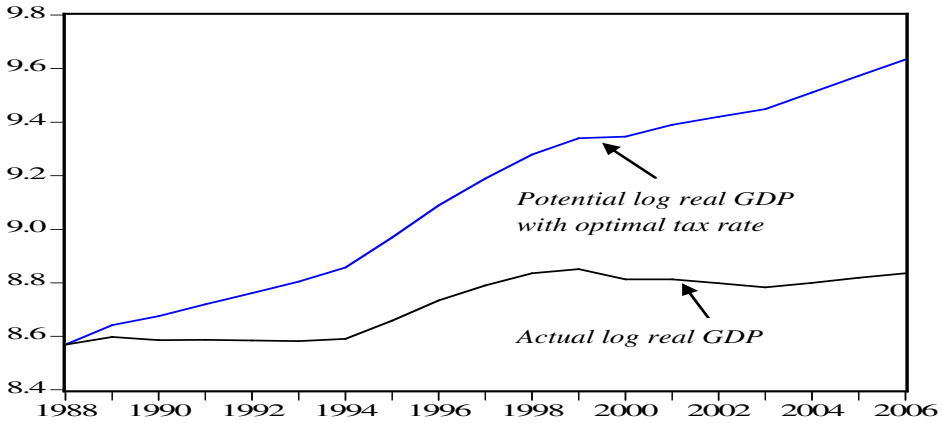

Figure 3. Path of log real GDP over time: Actual and with optimal tax rate.

R^2 = 0.992, DW = 2.06, LM(4) = 1.46 [0.83], $Q_{LB}(4)$ = 1.59[0.81], White = 5.06[0.40], JB = 1.45[0.48]

where figures in parenthesis are the *t*-statistics and those in brackets are p-values. Residual tests do not reveal any problem of mis-specification. Both the Breusch-Godfrey LM Test and Ljung-Box Q-statistic for serial correlation fail to reject the null hypothesis of no serial correlation. The White Heteroskedasticity test supports the null hypothesis and the Jarque-Bera test shows normality. The results show that all coefficients are statistically significant at 1% level. Equation (8) suggests that the optimal tax rate as a share of GDP is $\tau_1^* = 22.3\%$. In equation (9), we report the estimated coefficients of the quadratic form of the relationship between economic growth and tax rate.

$$g_t = \underset{(-2.580)}{-0.808} + \underset{(2.414)}{8.459}\tau_t - \underset{(-2.080)}{20.058}\tau_t^2 - \underset{(-5.159)}{0.070}D8190_t - \underset{(-5.524)}{0.199}D80_t - \underset{(-3.132)}{0.114}D65 + e_t \quad (9)$$

R^2 = 0.64, DW = 1.74, LM(4) = 2.63[0.61], $Q_{LB}(4)$ = 2.61[0.62], White = 6.70[0.34], JB = 0.12[0.94].

In parenthesis are presented the *t*-statistics, in brackets are the p-values, and $D8190_t = 1_{\{1981 \le t \le 1990\}}$; $D80_t = 1_{\{t=1980\}}$ and $D65_t = 1_{\{t=1965\}}$. They show that all coefficients are statistically significant at 1% level. Moreover, results are consistent with the hypothesis that taxes retard economic growth after a certain level. Solving for the growth-maximizing tax rate, the result in Equation (9) yields $\tau_2^* = 21.1\%$. Thus during periods in which the tax burden was less than about 21.1% of GDP, the effect of a tax increase on the economic growth rate was positive, and during times in which the tax rate exceeded 21.1%, an increase in tax burden was detrimental to economic growth.

The optimal (growth-maximizing) tax rate derived from the above equations is in the range of 21.1 and 22.3% of GDP. It is much greater than the actual tax rate. As such, the economic growth rate and, hence, the level of real GDP, is below that which would have been achieved if the optimal tax burden had been in effect throughout the period. At the optimal tax rate of 21.1%, the average economic growth rate would be 6.19%. Examining the historical data, the tax rates are far below 21% from 1988 to 2006. This means that the economy has grown more slowly than it would have if the rate of taxation had been constrained to the growth-maximizing level[7].

THE COSTS OF ACTUAL TAXATION

Our empirical estimation indicated that if the tax rate is greater than the optimal rate of 21.1%, increasing it will slow the rate of economic growth. However, instead of the growth-maximizing tax rate, the taxes were 20.4% of GDP in 1988 and continued to fall thereafter. This means that since 1988 the country is on the positive side of the inverted U curve. In this section, we want to quantify the cost of maintaining the existing tax rate, or the potential benefit to be gained by adopting the optimal tax rate.

Cumulative loss income

One way to measure the cost of the actual tax system is provided by the output gap measured as the difference between growth maximizing and observed real GDP. We plot in Figure 3 the time paths of actual GDP and potential GDP (log scale), assuming the same business cycle amplitude as actual real GDP. As shown in this

[7] Over the period 1988 to 2006, the mean tax rate was 16.12%, and the observed mean growth rate was about 1.46%.

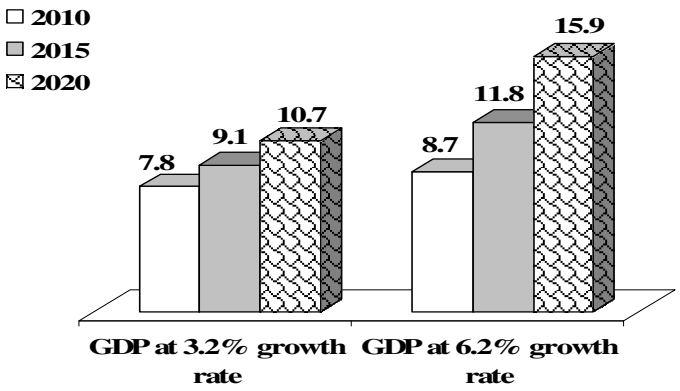

Figure 4. Projected GDP (trillions of FCFA).

figure, the output gap is growing and, hence, lower taxation causes a loss of output that is increasing over time. Real GDP grew from 1,294 billion (of Francs CFA) in 1960 to about 6,871.3 billion in 2006; reflecting a compound growth rate of 3.2% per year. If the optimal tax rate had been in effect throughout the 47-year period, real GDP would have been 27,212 billion in 2006. As a result, the country would have had more than four times as much real income as it had in 2006. However, if the optimal tax rate had been in effect over the period 1988 - 2006, the country would have had almost twice the real income it had in 2006. The output gap averages nearly 54% of observed real GDP over the period 1988 - 2006.

The accumulated real GDP from 1988 - 2006 was 116,733 billion. At the optimal tax rate, however, accumulated real GDP over the same period would have been 183,135 billion, or 66,402 billion more than the actual amount. Therefore, the loss of unrealized output due to taxation below the optimal level is 36.3% (66,402 billion divided by 183,135 billion).

Government tax revenues lost

The cost of the actual taxation or the potential benefit to be gained by moving to the growth-maximising taxation can also be quantified in terms of tax revenues lost. The accumulated real total tax paid by private agents over the period from 1988 to 2006 was 18,693.83 billion. But if the optimal tax rate had been maintained over the period, government would have been collecting taxes on a far larger tax base, thanks to a higher growth rate.

As a result, the combined governments would have collected a total of 38,613.86 billion in taxes, adjusted for inflation. This implies that had the country's total tax burden been limited to 21.1% of GDP, government would have collected 19,920 billion more in taxes. This additional revenue would fund the total of all deficits in real terms since 1988 and left perhaps the country debt free.

Projection of GDP and tax revenues

For the period from 1960 - 2006 taxes have consumed an average of 18.7% of the GDP. These rates have resulted in lower economic growth and lower tax revenues for the government, compared to the optimal tax rate. A tax burden of 21.1% would benefit all of a country. Figure 4 shows projected GDP in 4, 9 and 14 years with the growth rate at the optimal rate of taxation, compared to the current average GDP growth, beginning in 2006. As it shows:

- By 2010, projected GDP at a growth rate of 6.2% would amount to FCFA 8.7 trillion, compared to about FCFA 7.8 trillion at a 3.2% growth rate.
- By 2015, projected GDP at the higher growth rate would be FCFA 18.8 trillion, compared to only FCFA 9.1 trillion at the lower growth rate.
- By 2020, GDP would amount to FCFA 15.9 trillion or FCFA 5.2 trillion more than the amount of FCFA 10.7 trillion that would be at the lower growth rate.

Furthermore, at a growth rate of 6.2% and an average tax rate of 21.1% of GDP, tax revenues would more than equal revenues at the lower growth rate of 3.2% and lower average tax rate of 18.7%. As Figure 5 shows:

- By 2015, projected government tax revenues at the optimal tax rate would amount to FCFA 1.7 trillion, compared to FCFA 1.7 trillion at the average tax rate.
- By 2020, tax revenues at the growth-maximizing tax rate would be FCFA 3.4 trillion, a difference of FCFA 1.4 trillion from the amount at the average tax rate.
- From 2006 to 2020, government would collect total tax revenues of FCFA 3 281.5 trillion at the optimal tax rate, compared to only FCFA 2,296.7 trillion at the lower average tax rate, a difference of more than FCFA 950 trillion.

CONCLUSIONS

Economists are recognizing the great importance of getting tax policy right. As the overall tax burden has important consequences for the rate at which an economy grows, governments should ask whether the tax laws work against economic prosperity. In this paper, we have modelled the relationship between the level of taxation and the rate of economic growth and estimated the growth-maximizing tax rate. The research presented here supports the conclusion that higher taxes are strongly correlated with reduced economic growth. The tax rate that maximizes the growth rate is in the range of 21.1 to 22.3% of GDP. The actual tax rates are substantially far beneath the optimal tax rate. Hence, the economic growth and the level of real GDP as well as the amount of tax revenues are far lower than that which

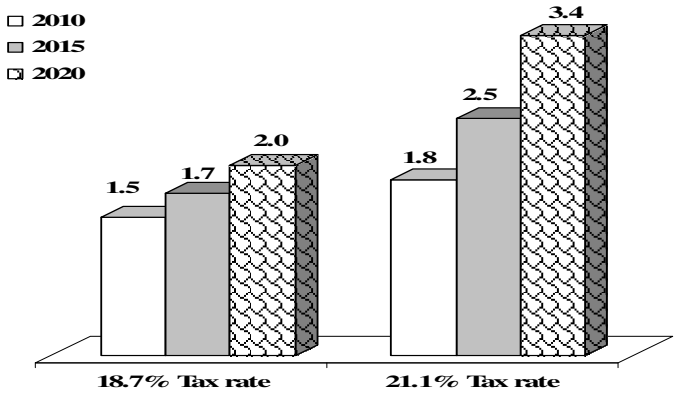

Figure 5. Projected potential tax revenue (trillions of FCFA).

would have been achieved if the optimal tax rate had been kept in effect throughout the period. The losses of GDP and tax revenues are substantial.

The major policy implication that we draw from this study is that if the country is to achieve long-term real rates of growth of GDP in the 6% per annum range, the actual level of tax rate needs to be increased by about 5 points of percentage of GDP. The overall tax burden can be raised up to 21.1% without sacrificing economic growth and tax revenue. A 1% increase in the tax burden would likely add 0.5% per year to economic growth. On the other hand, raising the rate of taxation from its actual to its optimal level would result in approximately doubling the level of real GDP and tax revenues every 10 years. This does not imply necessarily that government should increase the rates of different taxes or create new taxes. As there is a large share of potential resources that is not being collected by the tax system, a credible strategy should look for ways to improve the collecting system. Any attempt to improve the overall tax burden by raising tax rates without improving the efficiency of the tax system will be counter-productive. Increases in taxes are likely to encourage tax evasion and push economic activity underground. Additional efforts should be done by decentralizing the fiscal administration, eliminating fraud, evasion and corruption. Furthermore, government should try to return taxes back to the public in an efficient manner[8]. Taxpayers complain that government is not using taxes for development purposes. To justify their perception, they mention the increasing poverty among population, the insufficient electricity connection and the road damage. For these reasons, they find that government is squandering public resources on unproductive and political activities. Using taxes in an efficient manner by adequately investing in public goods and services could encourage tax compliance.

Our study suggests some promising topics for future research. First, it would be useful to examine the growth effect of different taxes in order to identify taxes that are more harmful to economic growth and those that are not. It might also be worthwhile to investigate the effects of different taxes on variables other than GDP, such as consumption, saving, investment, employment, or unemployment. This can shed light on the ways tax changes affect the aggregate economic growth. Second, an additional promising direction concerns the optimal structure of tax for the economy. There are empirical findings supporting that tax structure matters most for growth than the level of tax burden. Third, another interesting topic of research would be to investigate the impact of fiscal policy on the relative size of the hidden economy. It is widely agreed that underground economic activity in the form of tax evasion poses a serious threat for effectiveness of fiscal policy. Evaded tax revenue represents a deadweight loss on the economy, and it distorts taxation equity by shifting the taxation burden towards honest firms and individuals. Four, the main assumption underlying our investigation is that in estimating the optimal tax burden, the driving policy objective is one of maximizing the rate of growth of real GDP. It is possible that different policy objectives would lead to different estimates. A promising route would be to investigate the distributional effects of tax changes which may result in different taxation optima.

[8] In a study on sub-Saharan African countries, Skinner (1987) finds that a 5% increase in public investment, financed through taxation, reduces output growth rates by approximately 0.6% during the period 1974 to 1982.

REFERENCES

Agell J, Lindh T, Ohlsson H (1997). Growth and the public sector: a critical review essay. Eur. J. Pol. Econ., 135(1): 33-52.
Arnold J (2008). Do tax structures affect aggregate economic growth? Empirical evidence from a panel of OECD countries. OECD Economics Department Working Papers No. 643.
Auerbach AJ, Hines J (2002). Taxation and Economic Efficiency. In Auerbach A. J., M. Feldstein (eds), Handbook of Public Economics, 3, Elsevier, North-Holland.
Barro RJ (1990). Government spending in a simple model of endogenous growth. J. Pol. Econ., 98(5): S103-S125.
BCEAO (2006). Statistics Yearbook 2006. Central Bank of West African States.
Blanchard OJ, Perotti R (2002). An empirical haracterization of the dynamic effects of changes in government spending and taxes on output. Quart. J. Econ., 117(4): 1329-1368.
Bloom N, Griffith R, Van Reenen J (2002). Do R&D tax credit work? Evidence from a panel of countries, 1979-1997. J. Publ. Econ., 85(1): 1-31.
Branson J, Lovell CAK (2001). A growth maximising tax structure for New Zealand. Int. Tax Pub. Fin., 8: 129-146.
Cashin P (1995). Government spending, taxes, and economic growth. IMF Staff Papers, 42(2).
Chamley C (1986). Optimal taxation of capital income in general equilibrium with Infinite Lives. Econometrica. 54(3): 607–622.
Easterly W, Rebelo S (1993). Fiscal policy and economic growth: an empirical investigation. J. Mon. Econ., 32(3): 417-458.
Engen EM, Skinner J (1992). Fiscal policy and economic growth. NBER Working Paper 4223. Cambridge. MA: National Bur. Econ. Res.
Engen EM, Skinner J (1996). Taxation and economic growth. Nat. Tax J., 49(4): 617-642.
Fölster S, Henrekson M (2001). Growth effects of government expenditure

and taxation in rich countries. Eur. Econ. Rev., 45:1501-1520.
Garagata PJ, Giles DEA (1998). Stimulating the relationship between the hidden economy and the Tax Mix in New Zealand. Econometrics Working Papers. 9804. Dept. Econ., Univ. Victoria.
Hall B, van Reenen J (2000). How effective are fiscal incentives for R&D? A review of the evidence. Res. Pol., 29(4/5): 449-469.
Holcombe R, Lacombe D (2004). The effect of state income taxation on per capita income growth. Pub. Fin. Rev., 32(3): 292-312.
Helms LJ (1985). The effects of state and local taxes on economic growth: a time series cross-section approach. Rev. Econ. Stat., 67(4): 574-582.
Hill R (2008). Optimal taxation and economic growth: a comment. Pub. Choice., 134: 419-427.
Jaumotte F, Pain N (2005). From ideas to development: the determinants of R&D and patenting. OECD Economic Department Working Paper, No. 457.
Judd K (1985). On the performance of patents. Econometrica, 53(3): 567-585.
Karras G, Furceri D (2009). Taxes and growth in Europe. South-East. Europe J. Econ., 2:181-204.
Katz CJ, Mahler VA, Franz MG (1983). The impact of taxes on growth and distribution in developed capitalist countries: a cross-national study. Am. Pol. Sci. Rev., 77(4): 871-886.
Keho Y (2009). Budget balance through revenue or spending adjustments? An econometric analysis of the Ivorian budgetary process, 1960-2005. J. Econ. Int. Fin., 2(1): 1-11.
Kennedy PE (2000). On measuring the growth-maximizing tax rate. Pacific Econ. Rev., 5(1): 89-91.
Kesselman JR (1989). Income tax evasion: an intersectoral analysis. J. Pub. Econ., 38: 137-182.
Koester RB, Kormendi RC (1989). Taxation, aggregate activity and economic growth: cross-country evidence on some supply side hypotheses. Econ. Inquiry, 27: 367-386.
Kormendi RC, Meguire PC (1995). Macroeconomic determinants of growth. J. Mon. Econ., 16: 141-163.
Laffer AB (1981). Supply-side economics. Fin. Analysts J., 37(5): 29-44.
Levine R, Renelt D (1992). A sensitivity analysis of cross-country growth regressions. Am. Econ. Rev., 82(4): 942-963.
Lucas RE (1988). On the mechanics of economic development. J. Mon. Econ., 22(1): 3-42.
Mendoza E, Milesi-Ferretti G, Asea P (1997). On the effectiveness of tax policy in altering long-run growth: Harberger's superneutrality conjecture. J. Pub. Econ., 66(1): 99-126.
Musgrave RA (1959). The theory of public finance. New York, N.Y.: McGraw Hill.
Myles GD (2000). Taxation and economic growth. Fish. Stud., 21(1): 141-168.
Schwellnus C, Arnold J (2008). Do corporate taxes produce productivity and investment at the firm level? Cross-country Evidence from the Amadeus dataset. OECD Economic Department Working Paper, No. 641.
Scully GW (1995). The 'Growth tax' in the United States, Pub. Choice, 5(1/2): 71-80.
Scully GW (1996). Taxation and economic growth in New Zealand. Pacif. Econ. Rev. 1(2): 169-177.
Scully GW (2000). The growth-maximizing tax rate. Pacif. Econ. Rev., 5(1): 93-96.
Scully GW (2003). Optimal taxation, economic growth and income inequality. Pub. Choice, 115(3/4): 299-312.
Skinner J (1987). Taxation and output growth: evidence from African countries. NBER Working Paper No. 2335. Cambridge. MA: Nat. Bur. Econ. Res.
Slemrod J (1995). What do cross-country studies teach about government involvement, prosperity, and economic growth? Brookings Papers Econ. Activity, 2: 373-431.
Smith A (1776). A inquiry into the nature and causes of the wealth of nations. London: Methuen and Co., Ltd, ed. Edwin Cannan, 1904. Fifth edition. Archived on the World Wide Web at: http://www.econlib.or/library/Smith/smWN.html.
Stokey N, Rebelo S (1995). Growth effects of flat-rate taxes. J. Pol. Econ., 103(3): 510-550.
Trandel G, Snow A (1999). Progressive income taxation and the underground economy. Econ. Lett., 62: 217-222.
Vartia L (2008). How do taxes affect investment and productivity? an industry-level analysis of OECD countries. OECD Econ. Dept. Working Paper, No. 656.
Wang P, Yip CK (1992). Taxation and economic growth: the case of Taiwan. Am. J. Econ. Sociol., 51(3): 317-331.
Widmalm F (2001). Tax structure and growth: are some taxes better than others? Pub. Choice, 107(3/4): 199-219.
World Bank (1994). Une Infrastructure pour le développement. World Development Report, Washington D.C.
Zilcha I, Eldor R (2004). Firm' output under uncertainty and asymmetric information. Econ., 71: 141-153.