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Determination of an Optimal Threshold for Public Expenditure in Côte d'Ivoire

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Abstract

The objective of this article is to determine an optimal size of public expenditure in Côte d'Ivoire. We used annual secondary data covering the period 1970-2016. The quadratic model used is based on Vedder and Gallaway (1998). This model expresses a non-linear relationship between the volume of public spending and real gross domestic product (real GDP). We have found an optimal threshold for public expenditure of 34.50% of GDP in Côte d'Ivoire. A threshold above which public expenditure becomes detrimental to the health of the economy (Dar and Amirkhalkhali, 2002). If we consider the last five years, we can conclude that the Ivorian Government has reached its optimal level of public spending. This is justified by the positive GDP growth rate of 8.68% on average recorded by the Ivorian State (DGCPT, 2017). However, the achievements of socio-economic infrastructure by individual governments could only be fully appreciated if they could reduce social inequalities. Yet, the poverty line (46.3%) remains high in Côte d'Ivoire (ENV, 2015).

Keywords: Optimal threshold, public expenditure, economic growth

1. Introduction

The State's productive expenditure on economic activity is conducive to growth. All countries that make an investment effort are likely to experience economic growth (Solow, 1956). In the long term, growth rates may vary from one country to another. Dar and Amirkhalkhali (2002) have shown that a state's fiscal policy significantly influences its long-term economic performance, through fiscal policy control, spending and the budget balance. Public expenditure is expenditure made by the State, social security administrations and local authorities.

Economic growth refers to the positive change in the production of goods and services (GDP) in an economy over a given period of time. In the long term, growth has a significant impact on living standards. According to the theory of endogenous growth, growth is a self-sustaining phenomenon resulting from the accumulation of four main factors: technology, physical capital, human capital and public capital. The last factor corresponds to the socio-economic infrastructure created by the State and local authorities. Public capital also refers to investments in education and research (Barro, 1990). This theory highlights market imperfections given the competition that exists between firms. In this context, the State has the role of creating institutional infrastructures that support the profitability of private investment and subsidies for activities that are insufficiently profitable for economic agents and yet essential to society (Grossman and Helpman, 1991); (Aghion and Howih, 1992) and (Barro and Sal-i-Martin, 1995). Thus, in addition to its sovereign functions, the State is the exclusive investor in socio-economic infrastructure, such as the construction of communication facilities, expenditure in the field of education and health, expenditure on research and development, etc. These various achievements confirm the major role of the State in economic activity, as recommended by the Keynesian school.

Admittedly, public expenditure has positive externalities for private companies (Barro (1991) and Aschauer (1989)). However, an increase in public spending to a certain level would crowd out the private sector, which is essentially the pillar of economic growth. The 2012-2015 National Development Plan (NDP) confirms the Ivorian authorities' desire to place Côte d'Ivoire on the emergence path (ESSO and YEO, 2014). The State has embarked on a vast investment programme that will lead to economic and social development in the medium and long term.

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The NDP is renewed for the period 2016-2020 with the same economic and social development objectives, focusing on the structural transformation of the Ivorian economy (ESSO and YEO, 2014). Between 2012 and 2017, Côte d'Ivoire, with external assistance, was able to achieve significant quantitative results. As a result, it recorded an average increase in real gross domestic product (real GDP) of 9%. However, Côte d'Ivoire accumulates a stock of debt that is 42.2% of GDP. It is certain that this rate is below the community standards (WAEMU) which is 70%, relating to the multilateral convergence criteria on debt (Treasury and Public Accounting Branch, 2018). In a context of budget deficit in Côte d'Ivoire, what is the size of public spending that would maximize economic growth? The objective of this article is to determine an optimal threshold of public expenditure in relation to GDP that could trigger growth in Côte d'Ivoire. Such an analysis has certainly been mentioned many times in theory, but the quantification of this threshold, which we propose to measure in terms of the ratio of public expenditure to GDP (DPUB/GDP), has very rarely been undertaken, especially in the case of Côte d'Ivoire. To achieve the objective of this study, we propose to test a quadratic model inspired by Vedder and Gallaway (1998). This model expresses a non-linear relationship between the volume of public expenditure and real gross domestic product (real GDP).

The rest of this study is divided into three parts. In section 2, we review the theoretical and empirical literature that links public spending to economic growth. Section 3 presents the research methodology. And finally, in section 4, we will present and interpret the results.

2. Literature Review and Construction of the Operating Framework

Economic growth is the most important macroeconomic variable that reflects a company's overall performance. Several factors determine economic growth. In this article, we focus on public spending. Thus, through this literature review, we will first examine the linear relationship between public spending and economic growth. We will then see the non-linear relationship between the two variables. With regard to the linear relationship between public expenditure and economic growth, several authors have found different results. Other authors have based their work on the theoretical foundations of public spending as a source of growth. Indeed, public spending stimulates the productivity of private sector factors of production. Barro (1981) and Aschauer (1989) showed in their studies that public expenditures that enter the production function of private firms increase the marginal feasibility of capital and thus stimulate private investment rather than crowd it out.

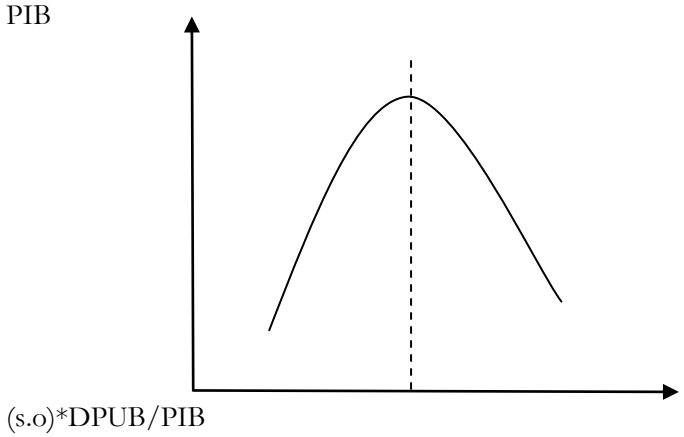
Cheng and Wei (1997) in an empirical study on South Korea, found a two-way causality between public spending and economic growth over the period 1954 to 1994. Similarly, a study conducted on the countries of the WAEMU (West African Economic and Monetary Union), Ouattara (2007) found a reciprocal relationship between public expenditure and economic growth. Over the period (1960-2013), Ngakosso (2016) obtained the same results in an empirical study conducted on Congo. In addition, other authors find a one-way causal relationship between public spending and economic growth. Thus, Kacou (2004) and Keho (2008) have shown that it is public spending that Granger-causes economic growth in Côte d'Ivoire. The development of endogenous growth theories has highlighted a positive link between public expenditure and economic growth. Using these models, some authors have concluded that public spending has a positive and significant effect on economic activity (Romer (1990), Barro (1990), Barro and Sala-i-martin (1990), Rajhi (1996) and Tanzi and Zee (1997)).

Myles (2009) and Coulibaly (2013) empirically confirm this result. They believe that public spending on infrastructure, education and health care is conducive to growth. Diagne and Fall (2007) also produced the same result by using ten industries for Senegal. They believe that public infrastructure spending is positively and strongly linked to factor productivity growth by contributing to the reduction of the cost of production. Thus, according to them, public spending can be a source of positive externalities and is a source of growth, Ram (1986). Kormendi and Meguire (1986) find a positive relationship between public spending and economic growth. They argue that public spending promotes private sector prosperity and encourages private investment that promotes economic growth.

Some authors find a negative relationship. Indeed, Creel et al (2005) have shown that the most effective way is to reduce public spending. According to them, lower spending would lead economic agents to anticipate a tax cut. This will boost aggregate supply and demand and would have beneficial effects on economic activity. Landau (1983), Engen and Skinner (1991), Folster and Henrekson (2001) and Dar and Amirkhalkhali (2002) find a negative relationship between economic growth and public spending. They show that the volume of public expenditure above a threshold has a decreasing return due to the crowding out effect of public expenditure on the private sector. In addition, public spending becomes inefficient when it causes distortions related to the non-transparent management (corruption) of allocative resources. Therefore, the distortions linked to the levying of taxes necessary to cover its expenses are higher than the profit they generate. Excessive taxes have a negative impact on the economy.

The Liberals confirm this idea of expanding public sector activities at the expense of the private sector (crowding out effect). The negative consequences of spending on the production of public goods and services have led the authors to find a certain threshold of public spending that should not be exceeded. Indeed, the optimal threshold for public spending has been the subject of several studies. The determination of the optimal size of public expenditure was borrowed from Laffer (1979).

Following Sheehey (1993), Vedder and Gallaway (1998) and Chen and Lee (2005), Armey (1995) uses the Laffer curve to present the non-linear relationship between the volume of public spending and economic growth. The construction of the Armey Curve is based on the idea that, when public expenditure is below a certain level (threshold), if the provision of a certain number of public goods (or public services) normally considered as providers of positive externalities favourable to private sector development is not ensured, then the level of overall product or the growth rate of the economy is low. On the contrary, when the level of public expenditure is very high, above the threshold, the weight of the State in the economy becomes excessive and the State becomes excessive, diverting too much wealth to its benefit, thus penalizing the private sector, which does not have sufficient means to accumulate enough resources to ensure good economic growth. The basic idea of this vision is that it is possible to justify the plotting of a curve of the type below linking the explanatory variable: the ratio of public expenditure to real GDP (DPUB/PIB) on the abscissa to the variable explained by real GDP on the ordinate.



The optimal threshold value (s.o)* is estimated by appropriate econometric methods. The aim is to directly explain the magnitude of GDP as a function of (DPUB/PIB) using a quadratic relationship. If the coefficient of the term (DPUB/PIB) squared is negative, then the ideal threshold can be calculated. In practice, it is a matter of determining the level that maximizes the GDP growth rate. The determination of the optimal threshold of public expenditure to GDP has been the subject of several studies. We can mention among others the study based on Barro's endogenous growth model (1990), the approach developed by Sculy (1989, 2003) and that developed by Hansen (1999, 2000). And finally, the model of Vedder and Gallaway (1998) and Herath (2010) constructed from the Armey curve. It is this last model that we will adapt to the study on Côte d'Ivoire.

3. Research Methodology

3.1. The model

The basic model in the empirical literature on the relationship between public spending and economic growth is based on the work of Vedder and Gallaway (1998) and Herath (2010), based on the Armey curve (1995). It is quadratic in shape as follows:

$$PIBREEL_t = C + \alpha_1(DPUB/PIB)_t + \alpha_2(DPUB/PIB)_t^2 + \varepsilon_t \quad (1)$$

With

PIBREEL: the real gross domestic product;
DPUB/PIB: the size of the government expressed as a share of total public expenditure as a percentage of real GDP; and
ε:the error term.

According to national accounts, public expenditure is classified according to its nature. Major expenditure items are as follows: The final consumption expenditure of the public administration (government) which includes the remuneration of public officials which recovers gross wages and salaries as well as social contributions and operating expenditure (fuel, telephone costs, office supplies, etc.); gross fixed capital formation (GFCF) which corresponds to investments in socio-economic infrastructure (construction of ports, roads, buildings, schools, health centres, etc.); interest charges are the expenditure or costs incurred by the State in repaying its debt.

From the theoretical literature analysed above, the choice of the different variables in the basic model will allow us to know their impact on real gross domestic product (PIBREEL). The model we are going to test is therefore the following:

$$\mathrm{PIBREEL_t} = \mathrm{C} + \alpha_1 \mathrm{DPUB/PIB_t} + \alpha_2 (\frac{\mathrm{DPUB}}{\mathrm{PIB}})_t^2 + \alpha_3 \mathrm{TIPR_t} + \alpha_4 \mathrm{TINF_t} + \alpha_5 \mathrm{OUVERT_t} + \varepsilon_t \qquad (2)$$

Where

PIBREEL is the real gross domestic product;
DPUB/PIB is the share of public expenditure in GDP;
TIPRis the rate of private investment;
TINFis the inflation rate;
OUVERTis the openness rate of the economy;
ε_t is the error term.

DPUB/PIB (Size of government) : The size of government expressed as the share of total public expenditure as a percentage of real GDP is a variable that should have a positive sign and is designed to show the beneficial effects of public expenditure on output (Myles, 2009) and (Coulibaly, 2013). The square term $(\mathrm{DPUB/PIB})^2$ of DPUB/PIB should, on the contrary, have a negative sign that measures all the adverse effects associated with increasing the size of government. In other words, it indicates the decline in marginal productivity of public spending (Lonzo and Avom, 2014).

In addition to the share of total government expenditure as a percentage of real GDP, we add the following explanatory variables: TIPR (the rate of public and private investment): public and private investment is taken as a proxy for gross capital formation as a percentage of gross domestic product (GDP). It is a growth factor, both for the neoclassical school and for Keynesian theory. Moreover, it is likely to generate externalities in line with recent results from endogenous growth models (Guellec and Ralle, 1997). Indeed, a company's investment allows it to increase not only its own production, but also that of other companies, because of the technological externalities it generates. Empirical studies of African economies (Ojo and Oshikoya, 1995; Ghura and Hadjimichael, 1996), for example, have shown a positive relationship between private investment and GDP per capita growth.

TINF (the inflation rate): is taken as a proxy for the consumer price index. Inflation reduces the purchasing power of economic agents and therefore negatively affects the decision to invest. Thus, it could have a negative effect on economic growth. On the other hand, some authors, such as Nubupko (2007), have shown that the increase in the inflation rate could be seen as a sign of economic growth. OUVERT (the degree of openness of the economy): the degree of openness of the economy is measured by the sum of imports and exports to GDP. Most studies have shown the positive relationship between openness and economic growth (Harrison, 1996; Frankel and Romer, 1999).

3.2. Data

Table 1: Variables sources

Variables	Definition	Formula/values	Data sources
PIBREEL	Real GDP Gross domestic product adjusted for changes in price levels.	Estimated values in billions of FCFA	World Bank World Development Indicators (2017); African Development Bank (CD-ROM, 2011).
DPUB/PIB	Public expenditure is the total expenditure made by general government as a percentage of GDP	$DPUB/PIB = \frac{DPUB}{PIB}$	World Bank World Development Indicators (2017); African Development Bank (CD-ROM, 2011).
TIPR	The share of gross private fixed capital formation in GDP	$TIPR = \frac{FBCF}{PIB}$	World Bank World Development Indicators (2017); African Development Bank (CD-ROM, 2011).
TINF	The inflation rate corresponds to the percentage increase/decrease in the prices of goods and services over a given period.	The inflation rate is taken as a proxy for the consumer price index (CPI).	World Bank World Development Indicators (2017); African Development Bank (CD-ROM, 2011).
OUVERT	The share of foreign trade in GDP	$OUVERT = \frac{domestictrade}{PIB}$	World Bank World Development Indicators (2017); African Development Bank (CD-ROM, 2011).

Econometric tests were carried out on annual data covering the period 1970-2016. The data used come from two sources. The World Bank World Development Indicators (2017) and the African Development Bank (CD-ROM, 2011). See table above.

4. Presentation and Interpretation of Results

The presentation and interpretation of the results will be as follows: the estimation of the linear model will be considered first. In a second section, we will estimate the quadratic model.

4.1. Estimation of the linear model

The stationary test is the first step in regression on temporal macroeconomic variables. Indeed, an augmented Dickey-Fuller unit root (ADF) test is performed to ensure that the results are stable and consistent. It appears that all the variables are not stationary in level. They become so at the first difference. That is, they are integrated of order 1, I(1) (Appendix 1). The integration of the same order of variables presumes the existence of at least one cointegration relationship between them. Subsequently, a Johansen cointegration test is performed on the variables to show the existence of a cointegration relationship between them. The result is presented in Appendix 2. The result shows three cointegration relationships between the variables considered. Finally, the tests carried out on the residues (Appendix 3) show that there is no problem of correlation of errors. The LM Breush Godfrey test rejects the null hypothesis of residue correlation. White's test rejects the heteroscedasticity hypothesis. Jacques-Bera's test highlights the normality of errors. After the various tests carried out on the variables, in a regression using ordinary least squares (OLS) methods of the linear relationship between public expenditure and GDP, we found the results below. We applied the Cochrane Orcut method to correct the correlation of errors.

Table 2: Estimation of the linear model by the Cochrane-Orcutt method

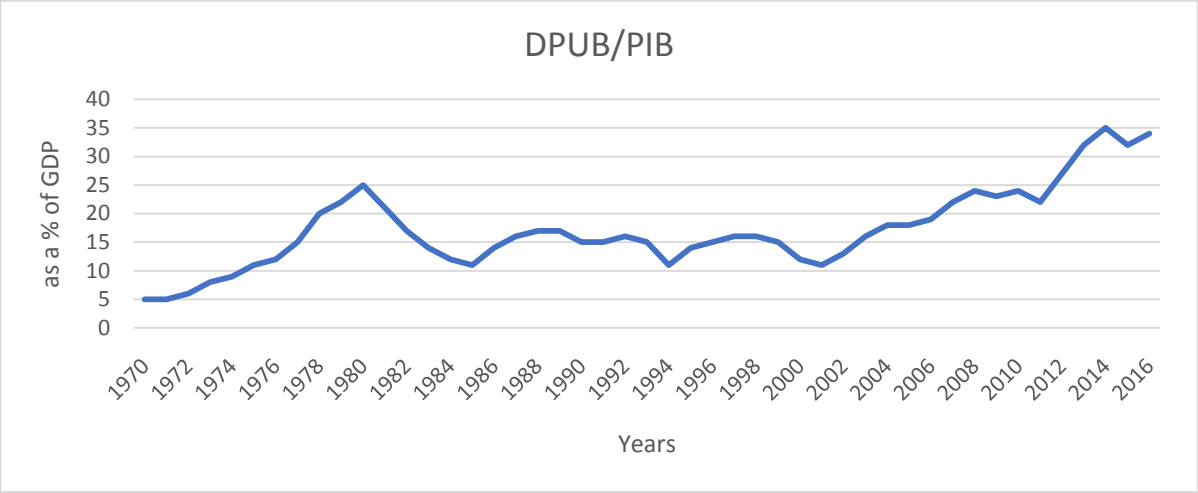
Explanatory variables	Coefficients	t-statistic	Probability
D(DPUB_PIB)	22,7434	0,6477	0,5212
D(TIPR)	77,3032	4,4377	0,0001
D(TINF)	-16,2602	-1,9170	0,0632
D(OUVERT)	29,2938	2,1009	0,0427
R^2 = 0,47 Ra^2 = 0,40 DW = 2,05 Prob (F-stat) = 0,0002			

Source: Author's estimation.

The result presented in Table 2 shows that the ratio of public expenditure as a percentage of GDP is positive (22.74) and not significant. However, the positive relationship of the outcome is consistent with some authors who have found a positive relationship between public spending and GDP (Romer, 1990; Barro, 1990; Barro and Sala-i-martin, 1990; Rajhi, 1996) and Tanzi and Zee, 1997). In contrast to public spending, private investment (77.30) and the share of foreign trade in GDP (29.29) have a positive and significant influence on economic growth. Our results confirm the negative relationship between inflation and economic growth (Lonzo, and Avom, 2014).

In a descriptive analysis, we can see the positive relationship between public expenditure and real gross domestic product (real GDP). See figure 1 below.

Figure1: Evolution of public expenditure as a percentage of real GDP in Cote d'Ivoire.



Source: author/data: World Bank

According to Figure 1 below, public spending as a percentage of GDP is moving in a saw tooth fashion. However, the study period can be broken down into four phases. The first phase covers the period 1970-1980. This period corresponds to the second decade of the Ivorian miracle. Period during which major investment works have been carried out by the State (Pegatienan, 1988). Examples include the construction of roads, bridges, schools, health centres and social housing, etc. The construction of socio-economic infrastructure has led to both foreign and domestic direct investment. Real GDP growth has increased dramatically during this period.

The second phase began in 1980 and lasted until 1985. This was an extremely difficult period for the Ivorian State. Since 1980, the prices of the main rents products (coffee and cocoa) fell drastically, plunging the Ivorian economy into an unprecedented economic and financial crisis. A period marked by two so-called structural adjustment economic reforms imposed by the Bretton Woods institutions. The private sector responded to this economic downturn by also contracting its capital expenditure by 11% (Berthélemy and Bourguignon, 1996). The third phase began in 1985 and lasted until 2002, a period of political crises that ended with a military coup in 1999.

The mini boom in coffee and cocoa prices since 1985 has encouraged increased public spending despite the reforms implemented (OECD, 1999). This increase in public expenditure is short-lived. It fell from 1988 to 1994, the date of the devaluation of the CFA franc. This political decision to change the parity of the CFA franc with the French franc favoured the increase in public and private investment, which was faded by the military coup in 1999. The fourth phase runs from 2002 to 2016. Despite the military-political crisis during this period, public spending has steadily increased. A period marked by a positive economic growth rate, except in 2011 when the growth rate is -4.38% (World Bank, 2012). Subsequently, after the linear model, we estimated the quadratic model.

4.2. Estimation of the quadratic model

The objective of this article is to determine the optimal threshold for public expenditure in Côte d'Ivoire. To do this, we estimated a quadratic model (equation 2) in a two-step least square (TSLS) regression. The results are provided in Table 3 below and in Appendix 5.

Table 3: Estimation of the quadratic model

Explanatory variables	Coefficients	t-statistic	Probability
DPUB_PIB	724,5703	4,3777	0,0001
DPUB_PIB_2	-10,50	-2,4935	0,0169
R^2 = 0,68 Ra^2 = 0,64 DW = 0,5951			

Source: Author's estimation.

The variable representing public expenditure has a positive and significant impact on economic growth. Its squared value has a negative and significant coefficient. This result confirms the hypothesis of an inverted "U-shaped" relationship between the volume of public spending and economic growth over the analysis period. In other words, the Armey curve is verified for Côte d'Ivoire. According to Vedder and Gallaway, (1998), cancelling the first derivative of the estimated equation with respect to the ratio of the volume of public spending to GDP provides the optimal threshold for public spending. This threshold is 34.50% of GDP in the case of Côte d'Ivoire. It is lower than that of all low-income countries, 36% of GDP and that of all middle-income countries, 38% of GDP. But it is also lower than that of high-income countries, which is 42% of GDP (Dione, 2016).

When we compare this optimal threshold with the different rates of public expenditure as a percentage of GDP over the analysis period, we can say that Côte d'Ivoire is below the optimal threshold of its public expenditure. However, in the last four years of the analysis period, the different rates of public expenditure exceed 30%. The good health of the Ivorian economy through economic growth, which averages 8.68%, confirms the positive relationship between public spending and economic growth (Treasury and Public Accounting Branch, 2017). According to economic theory, growth and sustainable economic and social development are achieved by the private sector. However, private investments are for themost part victims of the crowding-out effect caused by public spending.

Concluding Remarks

This article discusses the optimal size of public spending in Côte d'Ivoire. Based on the theoretical and empirical literature, we examined the linear and quadratic relationships between public spending and economic growth. In an empirical verification on Côte d'Ivoire, we showed, in a simple linear relationship, that the explanatory variables used in our regression confirm the theoretical literature. Indeed, public expenditure as a percentage of GDP has a positive effect on growth. The regression coefficient is 22.74 (Romer, 1990). Private investment and the degree of openness of the Ivorian economy also have a positive influence on economic growth, with significant coefficients of 77.30 and 29.23 respectively (Guellec and Ralle, 1997; Harrison, 1996; Frankel and Romer, 1999).

Unlike the first two variables, inflation has a negative effect on growth with a negative coefficient of 16.26 (Lonzo and Avom, 2004). Regarding the non-linear (quadratic) relationship between public expenditure as a percentage of GDP and economic growth, we have shown from data on Côte d'Ivoire that the optimal threshold for public expenditure is 34.50. A threshold above which public spending becomes detrimental to the health of the economy (Dar and Amirkhalkhali, 2002).

If we consider the last five years, we can conclude that the Ivorian State has reached its optimal level of public spending. This is justified by the positive GDP growth rate of 8.68% on average recorded by the Ivorian State (DGCPT, 2017). However, the achievements of socio-economic infrastructure by individual governments could only be fully appreciated if they could reduce social inequalities. Nevertheless, the poverty line (46.3%) remains high in Côte d'Ivoire (ENV, 2015).

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