Effects of Public Expenditure on Economic Growth in the CEMAC Subregion: A Comparative Analysis between the Fragile and Non-fragile States

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Bringing Rigour and Evidence to Economic Policy Making in Africa

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Contents

List of tables

List of abbreviations and acronyms

AfDB	African Development Bank
ARDL	Autoregressive Distributed Lag
BAD	Banque Africaine de Développement (African Development Bank)
BEAC	Bank of Central African States
CAR	Central African Republic
CEMAC	Economic and Monetary Community of Central Africa
DCs	Developed Countries
ECT	Error Correction Term
ICR	International Country Risk
IMF	International Monetary Fund
LDCs	Less Developed Countries
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
WAEMU	West African Economic and Monetary Union
WDI	World Development Indicators

Abstract

Chad, Central African Republic, and Congo have been identified by the African Development Bank as fragile states. Despite their socio-political stability, the other countries of the subregion, which are Cameroon, Gabon, and Equatorial Guinea, are exposed to risks of various kinds related to refugees from neighbouring countries and war against the Islamic sect Boko Haram. This study aims at carrying out a comparative analysis of the effects of public spending on economic growth in the aforementioned six countries by highlighting the differential effects of investment spending and consumption spending. The study covers the period 1975-2016. Time series regressions using the ARDL approach is applied. Taking into account the threshold effects for each country and each type of expenditure seems important for better formulation of policy recommendations. The results reveal a stable long-run relationship between public expenditure and the economic growth rate in the CEMAC subregion. Policies aiming at increasing the share of public investment expenditure to the detriment of public operating expenditure are recommended. Public expenditure should also be oriented towards productive development projects.

1. Background of the study and problem statement

The theoretical debate on the contribution of public spending to economic growth remains topical and controversial. Two main views are noted in the literature. First, the Keynesian approach that apprehends public spending as an engine of economic growth. Thus, state intervention boosts economic activity when the demand is depressed and slows it down when it is high and may lead to internal and external imbalances (Yovo, 2017b). In the short term, public spending can stimulate aggregate demand and boost economic growth. The argument in favour of public spending shows that public spending on roads, electricity, transport, telecommunications, education, and health generates externalities that improve the productivity of enterprises and can therefore support economic growth (Blejer & Khan, 1984). The increase in exports, which is a key sector for growth in Less Developed Countries (LDCs), requires the development of transport and communication infrastructures, resulting in the opening-up of rural areas and facilitates the transportation of products to the marketing centres. Such an improvement in exports would translate into an improvement in the balance of payments and overall demand. It is in this context that public expenditure contributes to the increase in the absorption capacity of the economy. They are, therefore, complementary to private production (Arrow & Kurz, 1970).

Contrary to the Keynesian approach, the second thesis defended by the neoclassical authors argues that an expansionary fiscal policy does not have a favourable effect on economic activity. According to these authors, policies of economic revival by public expenditure would produce depressive effects on the economy because public spending has a crowding-out effect on private investment and consumption. These negative effects stem from the fact that economic agents anticipate the future consequences of fiscal policy and adjust their consumption and savings behaviour accordingly (Feldstein, 1982; Barro, 1990).

This theoretical controversy has also led to a large empirical work, and the debate still inconclusive. The effects of public spending on economic growth vary as much by country or region as by the nature of spending.

The CEMAC[1] subregion is located in Central Africa. This subregion has been weakened by several decades of socio-political instability, as well as huge waves of refugees from unstable countries towards the more stable countries. This poses a threat to the macroeconomic equilibrium of the latter.[2] It is a situation that destabilizes

the entire subregion and destroys the capacity of states to pursue appropriate economic, social, and political management.

According to the African Development Bank, 19 African states are identified as fragile, including three CEMAC countries, namely Chad, Central African Republic, and Congo (BAD, 2014). The International Monetary Fund (IMF, 2017) has also classified these three countries as fragile. All these countries have been characterized in recent decades by socioeconomic instability, which has undermined the efforts of the leaders or policy makers in the implementation of the relevant public policies. The Republic of Congo, whose oil exploitation dates back several decades, could have taken off economically. The destabilization of this country by armed gangs who compete for oil revenues has transformed it from a middle-income country to a fragile country. Chad has been faced with a long civil war characterized by particularly deadly rebellions. The Central African Republic is one of the African countries with the highest number of coups.

The three other countries of the subregion, Cameroon, Gabon, and Equatorial Guinea, which share a border with these fragile countries, despite their relative socio-political stability, are shaken by the influx of refugees from these neighbouring states. The situation worsened with the war imposed by the Islamic sect, Boko Haram, for more than a year. Given the fact that all the six countries are in the same economic and monetary union characterized by a common monetary policy and a common currency, convergence criteria to be observed at the macroeconomic level, the various shocks faced by fragile states can affect the other countries both socially and economically.

All the above-mentioned countries were subjected to the structural adjustment plans following the economic crisis of the 1980s. Despite the austerity measures implemented, the expected results were not obtained. Statistics on public expenditure are provided for fragile countries and non-fragile countries for the period 1975-2016 (refer to Appendix 1 for graphs). According to the World Development Indicators (WDI, 2017) and the Bank of Central African States (BEAC), the total public expenditure registered a decrease of 3.5% in Cameroon between 1975 and 1980, but increased by 17.97% between 1980 and 1985. Between 1990 and 2000, a drop of 26.22% was observed concerning total public investment, before it registered an increase of 26.13% between 2000 and 2016. Concerning public investment expenditure of Cameroon, an increase on about 18% was observed between 1975 and 1980, but between 1985 and 1990, this variable decreased by 29.07%. From 1990 and 2000, a drop of 49.65% was also registered, and between 2000 and 2016, public capital investment increased by 63.37% of GDP. Concerning public consumption expenditure, from 1975 to 1980, it decreased by 10.95% and increased by 41.75% between 1985 and 1990. From 1990 to 2000, operating expenditure faced a decrease of 16.19%. Lastly, from 2000 to 2016, public consumption expenditure registered an increase of 15.28%. In Equatorial Guinea, total public expenditure as well as public investment expenditure decreased at a rate of 68.44% and 94.71%, respectively, between 1975 and 2016, while operating expenditure increased by 0.17% during the same period. Similar dynamics is observed in Gabon during the period of the study. In this country, total public expenditure

decreased by 36.51% during the study period while operating expenditure dropped by 21.76%. In the fragile countries (Central African Republic, Chad, and Congo), between 1975 and 2016, total public expenditure registered a downward trend of 43.84%, 61.59%, and 13.99%, respectively. The same is observed concerning operating expenditure, with a rate of decrease of 57.58%, 75.12%, and 22.18% in CAR, Chad, and Congo, respectively. Concerning capital expenditure, it increased by 6.69% and 31.95%, in CAR and Chad, respectively, and it decreased by 27.83% in Congo.

Based on the WDI (2017), the rate of growth of real GDP decreased by 60.42% in Cameroon, by 88.21% in Gabon, and by 557.42% in Equatorial Guinea. Concerning the fragile countries, Central African Republic faced an increase of 1019% in its real GDP, Chad and Congo, registered a decrease of 178% and 124%, respectively.

Given the controversy in the literature, the still difficult socioeconomic situation in the three CEMAC states identified by the African Development Bank (AfDB) as fragile[3], the situation of other states that are under various threats from neighbouring countries, should we not question the nature of the relationship between public spending and economic growth in all these states? In other words, can public expenditure be seen as an engine of growth in the CEMAC states? What comparison can be made between the effects of public spending on the economic growth of the CEMAC fragile countries and the effects this spending would have on the economic growth of other countries in the subregion? Can these effects vary between investment and operating expenditures? For countries with insignificant effects, what would be the threshold at which public spending would have a positive impact on economic growth?

2. Literature review

Review of theoretical work

The theoretical controversies about the effects of public spending on economic growth have their origin in the role of the state in the economy through fiscal policy.

In the late 1930s, Keynesian economists paid attention to the role played by the state as far as economic growth is concerned. They argued that public expenditures constitute an exogenous factor and a policy instrument that promotes economic growth since they stimulate the aggregate demand of the economy. The idea of the Keynesian theory is that government can boost economic performance by financing various spending programmes. Hence, public investment expenditures dedicated to public goods and services such as roads, health, telecommunications, electricity, and education stimulate aggregate demand and boost economic growth. Hence, high levels of government expenditures increase employment, profitability and investment via multiplier effects on aggregate demand. Public expenditure augments the aggregate demand, which leads to an increased output depending on expenditure multipliers (Patricia & Izuchukwu, 2013).

The Keynesian thesis can be better understood through a presentation made by Greffe (1995). By considering a closed economy, the author shows that the multiplier effect of budgetary expenditure has the same value as that of investment; the fiscal multiplier acts in a direction contrary to that of the budget multiplier. Greffe (1995) also shows that, in absolute terms, the budget multiplier is greater than the tax multiplier. When the state acts by expenditure, the equilibrium income is immediately modified by the level of the corresponding expenditure. When the state acts by tax, the aggregate income will be modified only when individuals have passed on to their expenditure the reduction of their disposable income which they support by tax; this results to a reduction of the effect since the coefficient applied to it is less than 1.

The effects of budgetary expenditures on income can best be seen through two assumptions made by Greffe (1995)[4]:

- The result related to the first assumption denounces the presupposition that a balanced budget is neutral; that is, it does not modify the equilibrium income. The neutrality of the budget, in the sense just defined, would therefore imply two conditions: on the one hand, the balance of the budget, and on the other the stability of the budget.

- Concerning the second hypothesis, when the amount of taxes is induced by income, the multiplier of public expenditure is lower. This decrease stems from the appearance of a new leak, which is the direct tax. This result can be interpreted in two ways: any fiscal stimulus is depreciated and the budget deficit leads to automatic compensation; if a given change in income is to be achieved, it is necessary to increase public expenditure more strongly than is implied by the budgetary multiplier alone.

Financing public expenditure through debt is widely used in many countries. However, this does not necessarily enhance economic performance. Economic agents may anticipate the manner they reimburse this public debt and this changes their behaviour. For this reason, Buchanan (1958) argued that financing public expenditure via debt transfers the burden to future generations because the government will raise taxes to pay the debt (Afonso & Ibraimo, 2018). Based on the Ricardian equivalence theory, Barro (1974) argued that it is inefficient to boost economic growth through fiscal stimulus. The Ricardian equivalence theory, stipulates that when an increase in government spending is financed by debt, it leads to an increase in private savings because the economic agents will anticipate an increase in taxes.

In spite of the efforts made by the Keynesian approach to build this model, it has been the subject of many criticisms from the neoclassical economists who question the positive relation between public spending and economic growth. The argument of the neoclassical theory is based on the assumption that public spending reduces private investment. According to the neoclassical theory, public spending negatively affects economic growth since public spending leads to budget deficit that crowds out private investment. That is, an increase in public spending leads to the substitution of public goods for private goods. This phenomenon leads to lower private spending on education, health, transportation, and other goods and services (Suleiman & Aamer, 2006). Moreover, the financing of public spending through higher levels of borrowing induces pressures in the credit market that result in higher interest rates and reduce investment in the private sector. The neoclassical growth literature identified the capital accumulation, labour force and exogenous technological progress as the driving factors of economic growth (Solow, 1956). According to the neoclassical growth model developed by Solow (1956), fiscal policy does affect economic growth mainly in the short run, given that in the long run, economic growth is achieved via an exogenous process that determines the rate of technological progress (Halkos & Paizanos, 2015). Solow (1957) further argued that intervention through fiscal policy helps to improve failure arising from the inefficiencies of the market (Iheanacho, 2016).

Contrary to neoclassical theory, the endogenous growth theory emphasizes the potential effect of public expenditures on economic growth (Barro, 1991; Barro & Sala-i-Martin, 1992). Through the endogenous growth model, Barro (1990) argued that the effect of public spending on economic growth depends on the source of financing used by the government; that is, the effect depends on how increased spending is financed. The expenditures can be financed through tax, government borrowing and

debts. If these expenditures are financed by a rise in direct taxation, the net effect on growth may be negative, despite a positive effect on the marginal productivity of private capital. If expenditures are financed by borrowing, then economic agents, who reason over a long period, understand that today's non-taxation is a tax deferral in the future. As a result, they save the surplus income due to today's non-taxation, to pay future taxes. This tends to reduce demand and the increase in public spending is compensated by the fall in private demand, thus reducing the effect of fiscal policy. This argument illustrates the Ricardian equivalence theory as defended by Barro (1974). Tax and borrowing are, therefore, seen as essential factors that directly reduce the purchasing power or the aggregate demand of the economy (Siew-Peng & Yan-Ling, 2015). This reduces the effects of the traditional Keynesian multiplier.

This controversy in the theoretical literature has been the subject of numerous empirical studies.

Empirical literature review

On the empirical level, researches on the effects of public spending on economic growth are hampered by a number of constraints linked to the nature and timeliness of this exercise. For this reason, the results of various studies differ according to the country or region, the methodology used, the nature of the data collected or the category of public expenditure. Following Diamond (1989; cited in Ouattara, 2007) who was one of the first researchers to study the effects of public spending on economic growth, numerous studies have focused on this issue. The work of Knight et al. (1993) resulted in a positive and significant effect of public infrastructure investment on growth in a sample of developing countries during the 1980s. Considering public investment in transport and communication in their approach, Easterly and Rebelo (1993) obtain the same conclusion for LDCs and DCs. Nelson and Singh (1994) also found a positive relationship between public infrastructure investment and economic growth in developing countries. Herrera (1998), in the context of DCs and LDCs, assessed the effects of public spending on education on long-run economic growth, highlighting the endogenous growth model by accumulation of human capital in a single sector. He admits that the dynamics of growth are driven by the state, whose choices of allocation of budget resources control the rate of accumulation of human capital. Dessus and Herrera (2000), in a study of 29 developing countries over an 11-year period, conclude that public spending on physical capital has a positive impact on economic growth. They adopted a panel data methodology of system of simultaneous equations. The work of Véganzonès (2001) on a panel of 87 countries, including 25 countries in sub-Saharan Africa, shows a positive impact of public investment in infrastructure on growth and a complementary relationship between public and private investment. Through Johansen cointegration approach on annual data from 1980 to 2008, Tamang (2011) investigated the impact of education expenditures on economic growth in India. The result of this study showed that there is a positive and significant effect of public

expenditure allocated to education and economic growth. Hussin et al. (2012) considered public spending on education in their study and showed that this variable positively and significantly affects economic growth in Malaysia. The VECM model is applied in their study. In the context of Nigeria, Ogungbenle et al. (2013) estimated a VAR model and found a bidirectional causality between public health spending and economic growth. The authors used annual time series data covering the period 1977-2008. Different types of public expenditure are considered by Marattin and Salotti (2014) in their study in Great Britain and Northern Ireland. They used a structural vector error correction model and showed that total public consumption and social security spending have a positive effect on private consumption. Marattin and Salotti (2014) estimated the multiplier effect of five different types of public spending on private consumption in the United Kingdom of Great Britain and Northern Ireland through a structural vector error correction model. They conclude that the total public consumption has a positive effect on private consumption and hence on economic growth. Syed et al. (2017) capture the growth effects of public physical and human capital investment in Pakistan. They used the Fully Modified Ordinary Least Square technique to measure the long-term relationship between these variables and economic growth at aggregate and disaggregate levels. The authors found a positive effect of public physical investment on economic growth.

On the other hand, many authors have also failed to find positive effects of public spending on economic growth. Thus, Ojo and Oshikoya (1995), by focusing on public investment in human capital, found in the case of sub-Saharan African countries, that an increase in public expenditure reduces GDP per capita growth. This result is similar to that found by Ghura and Hadjimichael (1996) and Ténou (1999), whose study in panel data relates to WAEMU countries. Ghura and Hadjimichael (1996) considered the ratio of the budget deficit to that of public consumption expenditure, while Ténou (1999) focused on the ratio of public consumption to GDP in percentage. Yovo (2017a) carried out a study on Togo and also showed that total government expenditure did not exert a positive externality effect on growth.

In the face of this controversy, numerous studies have focused on the comparison of the effects of public expenditure on investment with that of public consumption expenditure. Based on heterogeneous dynamic panel data from Korea, Singapore, and Taiwan, Bukhari et al. (2007) showed that public spending may contribute to economic growth in different ways. They found that public investment and public consumption have a long-term positive impact on economic growth. The authors also concluded that there exists bidirectional causality between public investment and economic growth. Using a neoclassical growth model estimated using the Two-Stage Least Squares method for the period 1980-2013, Yovo (2017b) assesses the impact of the level and the composition of public expenditures on growth in Togo. He concludes that the composition of public expenditures has significant effect on economic growth. He found public consumption negatively and significantly affects economic growth, while public investment has a positive and significant effect on economic growth. However, total government expenditures do not affect economic growth.

Devarajan et al. (1996) considered a group of 43 developing countries and found that the share of total government expenditure (consumption expenditure plus investment expenditure) has no significant effect on economic growth. However, taking into account the composition effect for government expenditure, the authors identified a positive and significant relationship between public consumption expenditure and economic growth, while a negative and significant relationship is obtained between public investment expenditure and economic growth. According to the authors, this result is explained by a misallocation of budgetary resources in favour of capital expenditure to the detriment of infrastructure maintenance costs.

Ghosh and Gregoriou (2008) obtained similar results for 15 developing countries.

Bose et al. (2003) disaggregated government expenditures by sector in their study based on a cross-country panel in 30 developing countries. The authors found that government capital expenditure and government education expenditure positively affect economic growth. Gupta et al. (2005) examined a sample of 39 low-income countries and showed that countries where public spending is more wage-oriented tend to have low growth rates, while those that invest more in capital register faster growth when spending is associated with a modest deficit. The results of works carried out by Keho (2008) on the Ivorian economy, Yovo (2017a) on Togo, and Saha (2014) on Cameroon show a positive impact of investment spending and the negative effects of government consumption expenditure on economic growth.

As can be seen, many works are in panel data and therefore cover several countries. Despite the relevance of analyses, the results obtained mask the disparities that could be detected between countries. In other words, cross-country growth regressions do not capture the dynamics of the relationship between public expenditure and economic growth variables and disregard country-specific factors. This aspect of the problem undermines the relevance and scope of the economic policy recommendations. For this reason, the present study will focus on individual countries.

In addition, threshold effects are not taken into account in empirical studies. In the case of non-significant results, it would have been important to determine the threshold at which total public expenditure, investment or consumption expenditure would have a positive effect on economic growth. Determining these thresholds would better guide the economic policy recommendations for each country. Thus, this aspect of the problem will also be the focus of this study. Finally, apart from the recent study by Saha (2014) on Cameroon, to the best of our knowledge, there are no studies highlighting the differentiated5 effects of public expenditure on the economic growth of countries in the CEMAC subregion. Thus, this study will also contribute to the literature in the region.

3. Methodology

Our study uses secondary data from the Central Bank of Central African States (BEAC) and World Development Indicators (WDI) published by the World Bank for macroeconomic variables, and International Country Risk (ICR) for the governance variable. These annual data cover the period 1975-2016, that is, 42 observations for each country. They are both quantitative and qualitative in nature. This comparative study focuses on the six CEMAC countries, three of which are classified as fragile (Congo, Chad, and Central African Republic) and the other three (Cameroon, Gabon, and Equatorial Guinea) which, despite their relative socio-political stability, face various threats from neighbouring countries that can expose them to a situation of fragility6 if adequate measures are not implemented.

For the status of fragility of the three countries of the CEMAC, refer to IMF (2017: 66). On the same page, the three other countries of this subregion, that is Cameroon, Gabon, and Equatorial Guinea, are classified as non-fragile. This, therefore, justifies the comparative analysis between fragile and non-fragile countries in the CEMAC zone.

The model to be used is based on the neoclassical economic growth model. According to Solow (1956), production (Y) or economic growth depends on capital (K) and labour (L) inputs. The production technology is given as follows:

$$Y = F(K, L) \tag{1}$$

By considering a Cobb-Douglas type production function, the model becomes:

$$Y = AK^{\alpha}L^{\beta} \tag{2}$$

The parameter A captures technological changes. Following Yovo (2017b), economic growth or growth output is closely related to the type of government expenditure used for the capital stock K and to the labour force L. By considering the logarithm of the production function, we have the following linear form:

$$\ln Y = lnA + \alpha lnK + \beta lnL \quad (3)$$

This equation can be rewritten as follows:

$$y = \alpha_0 + \alpha_1 DG + \alpha_2 L \quad (4)$$

In this equation, DG is the ratio of total government expenditure relative to GDP. The variable y captures the growth rate of the real GDP, and L is as previously defined. In this study, attention is paid to DG and L is neglected.

The equation can be expanded by disaggregating government expenditure into government capital expenditure relative to GDP (DI) and government consumption expenditure in relation to GDP (DF). Other variables are also included in the growth model. These variables are trade openness (TRADE), the primary school enrolment rate (TSP) which captures the effect of human capital on economic growth, the political risk index (IRP) which is an institutional indicator, and the debt service (SD).

The functional form of the model to be estimated for each country is as follows:

$$TCPB_t = f(c, DG, DI, DF, TRADE, TSP, IRP) \quad (5)$$

Taking into account this functional relationship and the different tests to be carried out, and following Yovo (2017b), two models will be estimated for each country. The first model (6) uses the total government expenditure, DG_t, as the main explanatory variable. The second model (7) includes the other types of public expenditure (government investment expenditure DI_t, and government consumption expenditure DF_t). Hence, we have the following equations:

$$TCPIB_t = \beta_0 + \beta_1 DG_t + \beta_2 TRADE_t + \beta_3 TSP_t + \beta_4 IRP_t + \varepsilon_t \quad (6)$$

$$TCPIB_t = \lambda_0 + \lambda_1 DI_t + \lambda_2 DF_t + \lambda_3 TRADE_t + \lambda_4 TSP_t + \lambda_5 IRP_t + \upsilon_t \quad (7)$$

In these equations, the following variables are used.

$TCPIB_t$ is the real GDP growth rate of each country for year t. This is the dependent variable.

The explanatory variables for each country for year t are as follows:

- DG_t is the variable of total government expenditure (operating or consumption expenditure plus capital expenditure) in relation to GDP;
- DI_t is the government investment expenditure in relation to GDP;
- DF_t is the government consumption expenditure in relation to the GDP;
- $TRADE_t$ is trade openness calculated by the ratio (imports + exports) / GDP;
- TSP_t is the primary school enrolment rate, this is to appreciate the behaviour of human capital on growth;
- IRP_t is the political risk index, which is institutional indicator reflecting government stability, socioeconomic conditions, corruption, the conduct of democracy, the quality of the bureaucracy, etc.

Given that one of the specific objectives of the present paper is a determination of thresholds level of government spending, the square values of public expenditure variables (total government expenditure, public investment expenditure and public consumption expenditure) are included in the two models. Hence, threshold effects will be verified using non-linear regression specifications (Lupu & Asandului, 2017; Yovo, 2017b). Thus, in order to determine the thresholds, models (6) and (7) become (8) and (9), respectively. These are the models to be estimated for each of the six countries of the CEMAC subregion:

$$TCPIB_t = \beta_0 + \beta_1 DG_t + \beta_2 DG_t^2 + \beta_3 TRADE_t + \beta_4 TSP_t + \beta_5 IRP_t + \varepsilon_t \quad (8)$$

$$TCPIB_t = \lambda_0 + \lambda_1 DI_t + \lambda_2 DI_t^2 + \lambda_3 DF_t + \lambda_4 DF_t^2 + \lambda_5 TRADE_t + \lambda_6 TSP_t + \lambda_7 IRP_t + \upsilon_t \quad (9)$$

In these equations, the square variable of total government expenditure is DG_t^2, the square variable of public investment expenditure is DI_t^2, and the square variable of public consumption expenditure is DF_t^2. The procedure for the determination of the threshold levels of public spending is presented in Appendix 2.

4. Data and estimated results

Before estimating the models, preliminary tests were performed. Appendix 3 presents the descriptive statistics while Appendix 4 presents the results related to the Augmented Dickey-Fuller (1979) test for stationarity for each of the six countries of the CEMAC subregion. The stationarity test shows that some variables are integrates at the level (I(0)) while others are integrated in first difference (I(1)). Hence the conditions for the use of ARDL model of Pesaran et al. (2001) are satisfied. Thus, the ARDL bounds test was performed and the conclusion is the existence of the short-run and the long-run relationships of the ARDL model.

The long-run and the short-run relationship between total government expenditure and economic growth

1. Estimation of the long-run relationship between total government expenditure and economic growth

The results from the long-run relationship are as follows:

Table 1: Estimation of the long-run model
(Dependent variable: Rate of growth of real GDP, TCPIB)

	Fragile Countries			Non-fragile Countries		
	CAR	**Chad**	**Congo**	**Cameroon**	**Eq. Guinea**	**Gabon**
DG	46.12431*	-2.652511	-2.615813**	-8.301987***	0.102934	3.185900*
	(21.13929)	(3.342686)	(0.986208)	(3.596900)	(0.638492)	(1.673963)
DG2	-1.241389*	0.009308	0.038894***	0.217235**	-0.004205	-0.065699**
	(0.573721)	(0.109614)	(0.013467)	(0.100846)	(0.004167)	(0.031521)
TRADE	-1.363102	0.197829	0.041084	0.355909***	0.272951***	-0.146569
	(0.777937)	(0.140803)	(0.058924)	(0.094755)	(0.068677)	(0.114728)
TSP	0.003085	-0.185406	0.129291	0.140427	0.066524	0.091006
	(0.495512)	(0.143416)	(0.112501)	(0.125040)	(0.069559)	(0.398468)
ICRG	4.532959	-2.271534	-4.477108	2.702626	-30.690853	11.415984
	(2.660192)	(3.637403)	(32.583571)	(10.722193)	(33.066290)	(20.606641)
C	-368.2167*	52.355701	25.800582	46.783254*	173.545050	-39.000460
	(177.5850)	(38.75818)	(26.861858)	(25.331817)	(239.564532)	(51.882631)
Adjusted R-squared	0.967400	0.449864	0.347329	0.368005	0.924360	0.542740
F-statistic	4.945761	1.253857	4.547770	4.881948	20.99722	5.629063
Prob(F-statistic)	0.040973	0.304308	0.001737	0.001076	0.0000	0.0001
Durbin-Watson stat	2.907141	2.352224	1.690479	1.937887	3.087888	2.345771
Number of Obs	41	41	41	41	41	41

continued next page

Table 1 Continued

(Dependent variable: Rate of growth of real GDP, TCPIB)

	Fragile Countries			Non-fragile Countries		
	CAR	**Chad**	**Congo**	**Cameroon**	**Eq. Guinea**	**Gabon**
LM test	6.635677	1.947236	0.9533715	2.573187	3.307070	2.79696
prob. LM	0.0792	0.1676	0.3960	0.2762	0.0570	0.1056
JB	5.014888	3.050894	1.508852	48.01304	1.04925	0.449632
prob. JB	0.081476	0.217524	0.470280	0.0000	0.5917	0.798663
White test	0.561217	0.396252	1.085908	0.404078	0.551548	1.134642
prob. White	0.8532	0.9694	0.4500	0.8711	0.8975	0.3717

Source: Authors, based on EVIEWS 9.

Notes: The values in brackets are standard deviations; *,**,***, represent significant level at 10%, 5%, and 1%, respectively.
LM test stands for the Breusch-Godfrey Langrange Multiplier (LM) test for autocorrelation.
JB is the Jarque-Bera normality test.
White test is the White test for heteroscedasticity.

2. Estimation of the short-run relationship between total government expenditure and economic growth

Table 2: Estimation of the error correction model (short-run dynamics)
(Dependent variable: Rate of growth of real GDP, TCPIB)

	Fragile Countries			Non-fragile Countries		
	CAR	**Chad**	**Congo**	**Cameroon**	**Eq. Guinea**	**Gabon**
D(DG)	-17.80213***	-2.564933	-1.772354***	-8.186349**	0.377115***	0.647610
	(4.208080)	(3.240685)	(0.562679)	(3.637353)	(0.100490)	(0.926841)
D(DG2)	0.516505***	0.054509**	0.026353***	0.214210**	-0.000625	-0.006824
	(0.118100)	(0.023271)	(0.007950)	(0.103076)	(0.001451)	(0.018043)
D(TRADE)	2.316081***	0.300778**	0.027837	0.350952***	0.102003**	-0.104972
	(0.393870)	(0.150679)	(0.040744)	(0.108335	(0.043911)	(0.080064)
D(TSP)	2.636149***	1.499478**	0.087601	0.138471	0.178773***	0.065178
	(0.515824)	(0.707072)	(0.074821)	(0.120319	(0.028838)	(0.287022)
D(ICRG)	3.136231*	-2.196534	-3.033483	2.664982	-38.941068**	-6.359757
	(1.407777)	(3.552650)	(22.050416)	(10.499060)	(14.028630)	(26.490894)
ECT(-1)	-0.691873**	-0.966983***	-0.677554***	-0.986071***	-0.599312***	-0.716193***
	(0.212134)	(0.187122)	(0.155735)	(0.152777)	(0.192849)	(0.117371)

Source: Authors, based on EVIEWS 9.
Notes: The values in brackets are standard deviations; *,**,***, represent significant level at 10%, 5%, and 1%, respectively.

The long-run and the short-run relationship between disaggregated public expenditure and economic growth

The estimation is done by disaggregating total government expenditure into government capital expenditure (DI) and government consumption expenditure (DF).

1. The long-run relationship between government capital expenditure (DI) and government consumption expenditure (DF) and economic growth

Government expenditures are disaggregated into operating and investment expenditures. This enables to access the contribution of the composition of public expenditure on economic growth.

Table 3 presents the results related to the long-run relationship between operating and investment expenditures and economic growth.

Table 3: Estimation of the long-run model (government capital expenditure DI and government consumption expenditure DF)
(Dependent variable: Rate of growth of real GDP, TCPIB)

	Fragile Countries			Non-fragile Countries		
	CAR	**Chad**	**Congo**	**Cameroon**	**Eq Guinea**	**Gabon**
DI	4.121811**	-8.863705**	-1.870898**	0.896059	0.353389	-0.662890
	(1.859504)	(3.913598)	(0.661646)	(1.455939)	(0.483325)	(0.797779)
DI2	-0.280537	0.591648**	0.044744**	-2.825297	0.003777	1.842164
	(0.190597)	(0.247897)	(0.015281)	(3.030794)	(0.003315)	(3.397819)
DF	2.677126	1.255228	4.003809	5.686061	-1.858525**	-3.322076
	(2.923782)	(3.571519)	(2.272618)	(9.790440)	(0.840691)	(1.762746)
DF2	-0.150762	-0.094728	-0.157515**	-41.339480	0.012693	28.021439
	(0.121306)	(0.157716)	(0.067126)	(53.286690)	(0.010909)	(14.298480)
TRADE	0.187803	0.236488*	0.233028**	14.361313*	0.013456	4.512811
	(0.111547)	(0.116130)	(0.102494)	(8.293974)	(0.064400)	(6.581854)
TSP	-0.191157*	-0.105939	0.421473**	3.798556	-0.056758	8.885908
	(0.108034)	(0.155148)	(0.149604)	(12.187981)	(0.079846)	(47.886205)
ICRG	-1.553013***	-4.237106	66.662734*	-4.007720	-42.304850*	-1.317221
	(0.486900)	(3.946452)	(34.795541)	(5.402777)	(21.098233)	(8.313208)
C	-5.142503	48.003026	-102.31290**	66.368885	315.260735**	-134.926004
	(19.330573)	(33.030159)	(34.242437)	(159.09676)	(148.483499)	(227.957106)
Adjusted R-squared	0.502102	0.200452	0.641480	0.847492	0.877761	0.512876
F-statistic	4.667062	1.716305	3.719657	5.264553	19.66980	4.732888
Prob(F-statistic)	0.0004	0.113300	0.008322	0.0004	0.0000	0.0004
Durbin-Watson stat	2.367836	2.315762	1.737729	2.651908	1.926140	2.291825
Number of Obs	41	41	41	41	41	41

continued next page

Table 3 Continued
(Dependent variable: Rate of growth of real GDP, TCPIB)

	Fragile Countries			Non-fragile Countries		
	CAR	**Chad**	**Congo**	**Cameroon**	**Eq Guinea**	**Gabon**
LM test	1.071956	1.451239	0.775397	4.000824	0.265373	0.992176
prob. LM	0.3565	0.2541	0.4841	0.0390	0.7693	0.3844
JB	0.014339	4.155492	0.303682	0.478335	1.692439	0.357935
prob. JB	0992856	0.125212	0.859125	0.787283	0.429034	0.836133
White test	2.465708	1.058132	1.053135	2.061845	2.204817	1.666415
prob. White	0.0255	0.4339	0.4785	0.0656	0.0407	0.1340

Source: Authors, based on EVIEWS 9.
Notes: The values in brackets are standard deviations; *,**,***, represent significant level at 10%, 5%, and 1%, respectively.

Table 4 presents the short-run relationship between economic growth and the composition of government expenditure.

Table 4: Short-run dynamics or ECM model (effects of government capital expenditure DI and government consumption expenditure DF)

(Dependent variable: Rate of growth of real GDP, TCPIB)

	Fragile Countries			Non-fragile Countries		
	CAR	Chad	Congo	Cameroon	Eq. Guinea	Gabon
D(DI)	5.168110**	0.755127	1.153975*	0.438286	-0.248085***	0.124726
	(2.237944)	(4.295188)	(0.569623)	(1.296264)	(0.082564)	(1.806935)
D(DI2)	-0.351749	-0.003762	-0.018932*	-2.791731	0.002389	1.829328
	(0.231390)	(0.236235)	(0.009095)	(2.917618)	(0.002242)	(3.366117)
D(DF)	-5.942401	-7.230441*	-0.858541	5.618508	-0.913926	-1.10619***
	(3.535805)	(4.232467)	(1.427297)	(9.822637)	(0.629753)	(0.384140)
D(DF2)	0.126898	0.289190*	0.040493***	-40.848346	0.008028	27.826181*
	(0.136459)	(0.165736)	(0.012635)	(53.818721)	(0.006798)	(14.493932)
D(TRADE)	-0.337861*	0.097083	0.298194***	14.190693*	0.184987***	-1.308043
	(0.185855)	(0.116305)	(0.078972)	(7.747257)	(0.031909)	(8.261482)
D(TSP)	-0.239681	0.557193	0.649053***	3.753427	0.129421***	8.823989
	(0.141427)	(0.562581)	(0.162591)	(11.999068)	(0.025698)	(47.688735)
D(ICRG)	-1.947237***	-4.163212	274.779655***	-3.960106	-42.57556***	4.481365
	(0.605670)	(3.867322)	(80.950400)	(5.455101)	(10.921986)	(6.639405)
ECT(-1)	-1.253844***	-0.982560***	-0.974179***	-0.98811***	-0.632517***	-0.99303***
	(0.135338)	(0.176319)	(0.214215)	(0.178273)	(0.141151)	(0.106954)

Source: Authors, based on EVIEWS9.

Notes: The values in brackets are standard deviations; *,**,***, represent significant level at 10%, 5%, and 1%, respectively.
The different version of the model estimated for CAR did not give a negative error correction term greater than -1.

Interpretation of the results

The results from different regressions are summarized in the tables above. From Table 1 to Table 4, it can be noted that, overall, these results are robust with respect to the probabilities related to Fisher statistics (F-statistics) which are significant at the 1% and 5% level. For all regressions that capture the short-run dynamics, the values of the error correction term (ECT) are negative, less than 1 in absolute values and significant; this further supports the long-run relationship and implies that the variables converge to a long-run equilibrium in case of a distortion. Hence, the error correction term (ECT) provides the speed of adjustment whereby short-run dynamics converge to the long-run equilibrium path in the model.

Considering the adjusted R-square values, they vary between 34% and 96% for the models dealing with total government expenditure and between 50% and 87% for the models based on disaggregated government expenditure (except the model of Central African Republic with an adjusted R-squared of 20%). While these are acceptable percentages overall, it can be noted that there are other variables that explain growth that have not been taken into account. The residual diagnostic tests are also performed (e.g., the White test for heteroscedasticity, Breusch-Godfrey test for serial correlation, the Jarque-Bera normality test). The results of these diagnostic tests reveal that in most of the models, there is no evidence of serial correlation and heteroscedasticity.

The rest of the comments are, on the one hand, in relation to the overall public expenditure, and on the other hand, in relation to the composition of public expenditure (public investment expenditure and public consumption expenditure). The comments are made in terms of comparison between the results of the long-run models and those of the short-run models, on the one hand, and between the fragile countries and the non-fragile countries of the CEMAC subregion on the other hand.

Among the three post-conflict and fragile countries that are Central African Republic (CAR), Chad and Congo, we note that in the long term, public spending has a positive (46.12) and significant effect on economic growth in CAR at 10% significance level. This unexpected result is similar to that found by Cheung and Lai (1993) on South Korea. For Chad, the sign is negative (-2.65) and not significant, whereas for the Republic of Congo the sign is negative (-2.61) and significant at 5% significance level. An increase in public spending of 1 unit leads to 2.61 units decrease in the economic growth rate. This result can be explained by the deterioration of governance in the Republic of Congo. The various governance indicators in this country are deteriorating, reflecting the impertinence of anti-corruption measures, the non-respect of democratic principles and the poor quality of the bureaucracy. For total public spending to have a positive effect on economic growth rate, it must reach a minimum threshold of 33.63% of GDP. But the average public expenditure in the Republic of Congo is only 30.11%.

For the other three relatively stable or non-fragile countries of the CEMAC, i.e., Cameroon, Equatorial Guinea, and Gabon, the signs of the coefficients related to

total public expenditure are positive (0.10) and insignificant for Equatorial Guinea and positive (3.18) and significant for Gabon at 10% significance level. An increase in total public expenditure of 1 unit leads to an increase of economic growth rate by 3.18 units in Gabon. However, the coefficient associated with total public expenditure is negative (-8.30) and significant for Cameroon at 1% significance level. It is insignificant for Guinea and significant for Cameroon and Gabon. These results are contrary to expectations. An increase in public spending of 1 unit reduces the economic growth rate by 8.3 units for Cameroon. The explanations given for Congo's results in relation to poor governance could apply for Cameroon with respect to the evolution of the institutional indicators of these countries.

Concerning the short-term models, total public expenditure has negative effects on the economic growth rate in all the three fragile countries of the CEMAC subregion. In the Central African Republic, the coefficient associated with total public expenditure is negative (-17.80) and strongly significant at 1%. In Chad, this coefficient is negative (-2.56) and insignificant. Concerning the Republic of Congo, the negative relationship (-1.77) between total public expenditure and economic growth rate is significant at 1% level. This could be explained by the negative consequences of fragility status on the use of total public expenditure and the extent of poor governance in these countries.

In the non-fragile or relatively stable countries, total public spending has a positive effect on the economic growth rate in Equatorial Guinea (0.377) and Gabon (0.65). This positive effect is strongly significant in Equatorial Guinea while it is insignificant in Gabon. Hence, in Equatorial Guinea, a 1 unit increase in total public expenditure induces an increase of economic growth rate by 0.377 units. These results for Equatorial Guinea and Gabon are as expected. Since the discovery and the exploitation of oil in Equatorial Guinea, this country engaged in a vast programme of development via the construction of various infrastructures among others; this policy boosts economic growth. However, in Cameroon, total public spending has a negative (-8.18) and significant effect on the economic growth rate at 5% significance level. An increase of 1 unit in total public expenditure reduces the economic growth rate by 8.18 units. Once more, this negative result for Cameroon raises a question on the quality of governance and precisely how public expenditure is used in this country. Cameroon is characterized by a low rate of budget execution decried by donors as well as by civil society, and governance issues. For this last aspect, the indicators of governance of Cameroon, whatever the sources, are deteriorating. Indeed, for several decades, Cameroon is part of Transparency International countries whose anti-corruption measures are lax and irrelevant. The sectors most concerned are the security services, the financial departments and the justice system.

Now, we consider the effects of disaggregated public expenditure on the economic growth rate. The comments on the results also differentiate the long-run models from the short-run models. Once more, a distinction is made between the case of fragile countries and non-fragile countries.

In the long run, for the three post-conflict and fragile countries, the results obtained are as expected for Chad and Congo. In these countries, there is a negative

and significant relationship between public investment expenditure and the rate of economic growth, at 5% significance level. However, in the Central African Republic, there is a positive and significant relationship between public investment expenditure and the rate of economic growth, at 5% significance level. This positive effect for CAR, which is a fragile country, is an unexpected result.

Regarding operating expenses, the signs are positive and insignificant for all the three fragile states. These positive signs, even if they are insignificant, were not expected. In these countries, in view of their socio-political instability, considerable proportions of public expenditure would have been directed to weapons equipment and the maintenance of troops at the front, to the detriment of the infrastructures that could have supported the private sector creating wealth. The health and education investments needed to improve human development are also marginalized in these countries.

For investment spending to positively impact growth, it must reach at least 7.49% and 20.91%, respectively, in Chad and in the Republic of Congo. However, the respective averages of public investment expenditure in these countries are only from 4.42% for Chad and 12.75% for the Republic of Congo.

For the three non-fragile countries of the CEMAC, public investment expenditure is positively associated with the economic growth rate. That is, an increase in public investment expenditure in these countries would lead to an increased economic growth rate. All the coefficients of public investment expenditure are positive and insignificant.

Concerning operating expenditure, it negatively and significantly affects economic growth rate in Equatorial Guinea as expected. In Gabon, the relationship is also negative as expected. The threshold at which public operating expenditure can positively affect economic growth rate in Equatorial Guinea is 73.21% of GDP, which is higher than the average of 20.45% of GDP for the considered period in this study. In Cameroon, public operating expenditure is positively and insignificantly related to economic growth rate.

For the short-run dynamics, the sign of public investment spending in so-called fragile countries is positive and significant for Central African Republic and Congo, and positive but insignificant for Chad. Concerning public operating expenditure, it negatively and significantly affects economic growth rate in Chad, while the negative relationship in CAR and Congo is not significant.

For the non-fragile countries, public investment expenditure positively influences economic growth rate in Cameroon and Gabon. However, in Equatorial Guinea, the effect of total public expenditure is negative and significant. This result is similar to those of Devarajan et al. (1996) and is due to a misallocation of capital expenditures. This is a result contrary to expectations. The threshold at which total public expenditure can affect economic growth positively in Equatorial Guinea is 24.25% of GDP. The average of total public expenditure in this country is 23.51%.

All the results discussed above can easily be viewed in tables 5 and 6.

Table 5: Results concerning the long-run dynamics
(Dependent variable: Rate of growth of real GDP, TCPIB)

	Fragile Countries			Non-fragile Countries		
	CAR	**Chad**	**Congo**	**Cameroon**	**Eq. Guinea**	**Gabon**
DG	46.12431*	-2.652511	-2.615813**	-8.301987***	0.102934	3.185900*
	(21.13929)	(3.342686)	(0.986208)	(3.596900)	(0.638492)	(1.673963)
DG2	-1.241389*	0.009308	0.038894***	0.217235**	-0.004205	-0.065699**
	(0.573721)	(0.109614)	(0.013467)	(0.100846)	(0.004167)	(0.031521)
DI	4.121811**	-8.86370**	-1.870898**	0.896059	0.353389	-0.662890
	(1.859504)	(3.913598)	(0.661646)	(1.455939)	(0.483325)	(0.797779)
DI2	-0.280537	0.59164**	0.044744**	-2.825297	0.003777	1.842164
	(0.190597)	(0.247897)	(0.015281)	(3.030794)	(0.003315)	(3.397819)
DF	2.677126	1.255228	4.003809	5.686061	-1.858525**	-3.322076
	(2.923782)	(3.571519)	(2.272618)	(9.790440)	(0.840691)	(1.762746)
DF2	-0.150762	-0.094728	-0.157515**	-41.339480	0.012693	28.021439
	(0.121306)	(0.157716)	(0.067126)	(53.286690)	(0.010909)	(14.298480)

Source: Authors, based on EVIEWS 9.
Notes: The values in brackets are standard deviations; *,**,***, represent significant level at 10%, 5%, and 1%, respectively.

Table 6: Results concerning the short-run dynamics

(Dependent variable: Rate of growth of real GDP, TCPIB)

	Fragile Countries			Non-fragile Countries		
	CAR	**Chad**	**Congo**	**Cameroon**	**Eq. Guinea**	**Gabon**
D(DG)	-17.80213***	-2.564933	-1.772354***	-8.186349**	0.377115***	0.647610
	(4.208080)	(3.240685)	(0.562679)	(3.637353)	(0.100490)	(0.926841)
D(DG2)	0.516505***	0.054509**	0.026353***	0.214210**	-0.000625	-0.006824
	(0.118100)	(0.023271)	(0.007950)	(0.103076)	(0.001451)	(0.018043)
D(DI)	5.168110**	0.755127	1.153975*	0.438286	-0.24808***	0.124726
	(2.237944)	(4.295188)	(0.569623)	(1.296264)	(0.082564)	(1.806935)
D(DI2)	-0.351749	-0.003762	-0.018932*	-2.791731	0.002389	1.829328
	(0.231390)	(0.236235)	(0.009095)	(2.917618)	(0.002242)	(3.366117)
D(DF)	-5.942401	-7.230441*	-0.858541	5.618508	-0.913926	-1.10619***
	(3.535805)	(4.232467)	(1.427297)	(9.822637)	(0.629753)	(0.384140)
D(DF2)	0.126898	0.289190*	0.040493***	-40.848346	0.008028	27.826181*
	(0.136459)	(0.165736)	(0.012635)	(53.818721)	(0.006798)	(14.493932)

Source: Authors, based on EVIEWS 9.

Notes: The values in brackets are standard deviations; *,**,***, represent significant level at 10%, 5%, and 1%, respectively.

Determination of the thresholds related to government expenditure

The thresholds are determined for the variables related to government spending (total government expenditure , public investment expenditure , and public consumption expenditure). The different thresholds are determined based on the sign of the coefficient related to expenditure variable and the sign of the coefficient of the square variable of this expenditure. A threshold is determined only when the two coefficients have opposite signs.

When the coefficient related to public spending is positive and the coefficient related to the square of public spending is negative, public spending has a positive effect on economic growth while the square variable of public spending has a negative impact on economic growth. In this case, it is important to determine the point beyond which an increase in public spending reduces the economic growth rate, that is, the negative consequences of an oversized state (Lupu & Asandului, 2017). When the coefficient related to public spending is negative and the coefficient related to the square of public spending is positive, public spending has a negative effect on economic growth while the square variable of public spending has a positive impact on economic growth. In this case, it is important to determine the point beyond which an increase in public spending induces economic growth rate.

The thresholds associated with the government expenditure are presented by considering long-run as well as the short-run dynamics. These thresholds are related to total government expenditure (DG), government investment expenditure (DI) and government consumption expenditure (DF). The results are presented in Table 7.

Table 7: Determination of the thresholds related to the long-run and short-run relationship between the rate of growth and government expenditure

	Fragile Countries			Non-fragile Countries		
	CAR	**Chad**	**Congo**	**Cameroon**	**Eq. Guinea**	**Gabon**
Thresholds related to the long-run relationship between the rate of growth and total government expenditure (DG)						
DG	46.12431*		-2.615813**	-8.301987***		3.185900*
DG2	-1.241389*		0.038894***	0.217235**		-0.065699**
Threshold	**18.58**		**33.63**	**19.11**		**24.25**
Mean	**17.51**		**30.11**	**15.37**		**23.51**
Thresholds related to the short-run relationship between the rate of growth and total government expenditure (DG)						
Δ(DG(-1))	-17.80213***	-2.564933	-1.772354***	-8.186349**	0.377115***	
Δ(DG2(-1))	0.516505***	0.054509**	0.026353***	0.214210**	-0.000625	
Threshold	**34.47**	**23.53**	**33.63**	**19.11**	**301.69**	
Mean	**17.51**	**15.37**	**30.11**	**15.37**	**66.91**	
Thresholds related to the long-run relationship between the rate of growth and capital government expenditure (DI)						
DI	4.121811**	-8.863705**	-1.870898**			
DI2	-0.280537	0.591648**	0.044744**			
Threshold	**7.35**	**7.49**	**21.03**			
Mean	**4.72**	**6.42**	**12.76**			
Thresholds related to the long-run relationship between the rate of growth and public consumption expenditure (DF)						
DF			4.003809		-1.858525**	
DF2			-0.157515**		0.012693	
Threshold			**12.71**		**73.21**	
Mean			**17.35**		**20.46**	

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Table 7 Continued

	Fragile Countries			Non-fragile Countries		
	CAR	**Chad**	**Congo**	**Cameroon**	**Eq. Guinea**	**Gabon**
Thresholds related to the short-run relationship between the rate of growth and capital government expenditure (DI)						
Δ(DI)	5.168110**		1.153975*		-0.248085***	
Δ(DI2)	-0.351749		-0.018932*		0.002389	
Threshold	**7.35**		**30.48**		**51.92**	
Mean	**4.26**		**12.76**		**46.45**	
Thresholds related to the short-run relationship between the rate of growth and public consumption expenditure (DF)						
Δ(DF)		-7.230441*	-0.858541			-1.10619***
Δ(DF2)		0.289190*	0.040493***			27.826181*
Threshold		**12.47**	**10.60**			**1.02**
Mean		**8.95**	**17.35**			**14.80**

Source: Authors.

Total public expenditure negatively and significantly affects economic growth rate in Cameroon in the long run, the threshold at which this relationship could be positive is achieved when total public expenditure represents 19.11% of GDP as compared to an average of 15.37% during the study period. In the short run, a negative relationship is also observed between the two variables. The threshold for a positive relationship is 19.11% against a mean of 15.37%. In Equatorial Guinea, a negative and significant relationship is observed between public investment expenditure and economic growth. This could become positive with a threshold of 51.92% as compared to an average of public investment expenditure of 46.45% of GDP.

In Central African Republic, the long-run model exhibits a negative and significant relationship between total public investment and economic growth rate. The threshold of total public investment relative to GDP that could render the relationship significant is 34.47% compared to an average of 17.51% during the period of the study. In Chad, the negative and significant relationship between economic growth and total public expenditure could become positive if total public expenditure has a threshold of 23.53%, which is greater than the average of 15.37%. Still in Chad, public investment expenditure negatively and significantly affects economic growth; the threshold for a positive relationship is 7.49% compared to an average of 6.42%. In the Republic of Congo, a negative and significant relationship is registered between total public expenditure and the economic growth rate. The threshold of total public expenditure relative to GDP that could make this variable to positively affect economic growth in Congo is 33.63% while the average is 30.11%. Since this relationship is also negative and significant in the short-run model, the threshold for a positive relationship is also 33.63%. Concerning public investment expenditure, the negative and positive relationship is obtained and it could be positive with a threshold of 30.48%.

5. Conclusion and recommendations

The initial objective of this study was to compare the effects of public spending on economic growth between the countries classified as fragile by the 2014 report of the African Development Bank and the non-fragile countries of the CEMAC zone.

The results show that there is no fundamental difference between these two groups of countries in terms of the contribution of public spending to economic growth. This means that all countries in the subregion are not resilient to economic shocks. However, on average, total public expenditure is positively associated with economic growth rate in non-fragile countries as compared with fragile countries. Concerning total investment expenditure, on average, it positively affects economic growth rate in non-fragile countries. As far as operating expenditure is concerned, on average, a negative relationship is found between this variable and economic growth rate in non-fragile countries.

If the three countries of Chad, Congo, and Central Africa are considered fragile in relation to their post-conflict situation, all CEMAC countries are vulnerable to macroeconomic imbalances such as the chronic trade deficit, budget deficit, excessive reliance on debt, and deterioration of governance. In addition, these countries use as their currency the CFA franc whose fixed parity with the EURO does not make money an instrument of economic policy. This is why in December 2016, an extraordinary summit of CEMAC was held in Yaoundé, during which all the countries in the CEMAC were put under adjustment. Since they are oil exporting countries, they have been greatly affected by the drop in the price of a barrel of oil since 2014. In addition, this subregion is affected by attacks by the terrorist group Boko Haram in Chad and Cameroon.

Cameroon is also facing security problems in English-speaking areas with political demands and in the eastern region with refugees from the Central African Republic. This situation destabilizes the entire subregion since Cameroon is border with all other countries.

The economic policy recommendations to be formulated will concern all CEMAC countries. More importantly, it would be appreciable to increase public investment expenditure and reduce the share of the budget allocated to operating expenditure, both in fragile and non-fragile countries. Governance issues should be solved for government expenditure to have a major impact on the economy and the society. The choice of development programmes to be implemented should also be crucially made. Based on our results, further short-term and long-term policy recommendations will be made. They will also take into account the specificities of each country in terms of the economic structures, level of governance, and development programmes being implemented.

Notes

1. CEMAC refers to the Economic and Monetary Community of Central Africa. The CEMAC subregion groups six countries: Cameroon, Congo, Central African Republic, Equatorial Guinea, Gabon, and Chad.

2. According to the International Monetary Fund (IMF), states are fragile because of the collapse of their economies, the dysfunction of the law enforcement system and the proliferation of conflict-related diseases. They have negative repercussions on their neighbours (FMI, 2011). Collier (2007) estimated that the cost to a fragile state and its neighbours for the duration of fragility is about US$100 billion.

3. The African Development Bank defines fragility as a high-risk situation of social collapse or violent conflict. Factors of fragility include economic, social, and environmental dimensions (BAD, 2014).

4. Hypothesis 1: Assuming a balanced variation of the budget: $\Delta G = \Delta T$, the corresponding increase in income will be given by: $\Delta Y = \frac{1}{1-a}\Delta G - \frac{a}{1-a}\Delta G = \left(\frac{1-a}{1-a}\right)\Delta G = \Delta G$. So, we have: $\Delta Y = \Delta G = \Delta T$. Hypothesis 2: Assuming that the tax amount T is expressed in the form: $T = tY + k$, where t is the direct tax rate and k is a constant quantity. We then obtain: $Y = \frac{1}{1-(1-t)a}[G + I + b + ak]$ and $\Delta Y = \frac{1}{1-(1-t)a}\Delta G$.

5. In this study, government expenditures are separated into productive and non-productive spending. Based on endogenous growth model, Barro (1990) showed that only productive government expenditures positively affect the long-run growth rate.

6. According to the African Development Bank, violence is spreading across borders, leaving refugees and damaged infrastructure in its wake. It estimates that the cost of conflicts related to the shortfall in economic growth in neighbouring countries, each with a loss of about 0.6% per annum, is about 80% (BAD, 2014).

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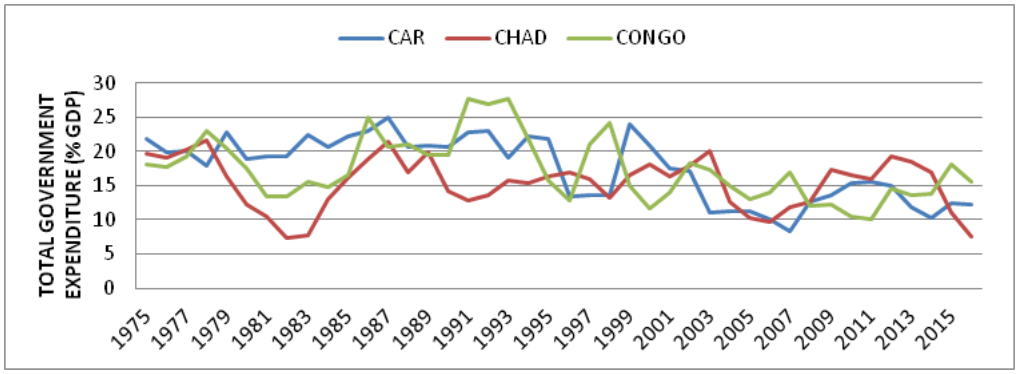
Appendixes

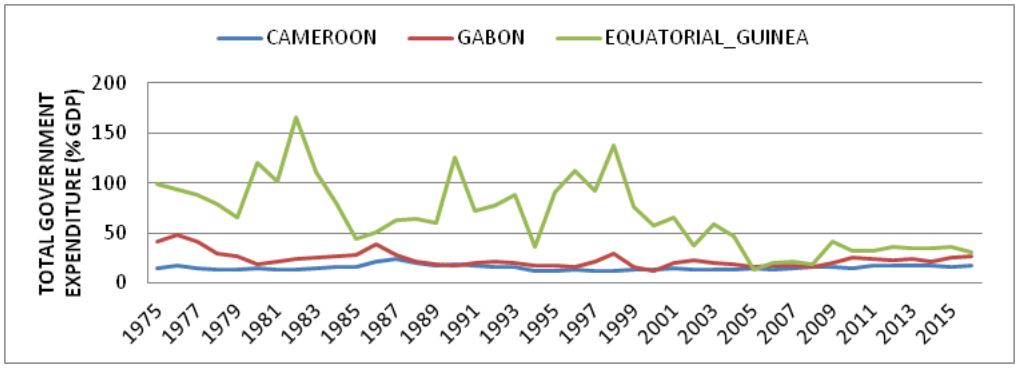
Appendix 1: Evolution of total government expenditure in fragile and non-fragile countries

Graph for fragile countries



Source: Constructed by authors.

Graph for non-fragile countries



Source: Constructed by authors.

Appendix 2: Procedure for the determination of the thresholds

The thresholds are determined for the three variables related to government spending. That is, total government expenditure *DG*, public investment expenditure *DI*, and public consumption expenditure *DF*. The different thresholds will be determined based on the sign of the coefficient related to expenditure variable and the coefficient of the square variable of this expenditure. It will be possible to determine a threshold only when the two coefficients have opposite signs. For example, taking the total expenditure variable *DG*, the procedure used to determine the thresholds is as follows:

- If for the variable DG, $\beta_1 > 0 \quad and \quad \beta_2 > 0$, then, total public spending has a positive effect on economic growth. In this case, it is not possible to determine a threshold.

- If $\beta_1 > 0 \quad and \quad \beta_2 < 0$, then, public spending has a positive effect on economic growth. However, the square variable of public spending has a negative impact on economic growth. In this case, it is important to determine the point beyond which an increase in public spending reduces the economic growth rate, that is, the negative consequences of an oversized state (Lupu & Asandului, 2017).

The threshold beyond which this effect becomes negative is:

. $\frac{\partial(TCPIB_t)}{\partial(DG_t)} \geq 0 \quad \Rightarrow \quad \beta_1 + 2\beta_2 DG_t \geq 0$ We will then have $DG_t \geq -\frac{\beta_1}{2\beta_2}$. Given that $\beta_2 < 0$, the sign of the ratio $-\frac{\beta_1}{2\beta_2}$ must change and become ≤ 0. The threshold level beyond which public spending has a negative effect on economic growth is $DG_t \leq -\frac{\beta_1}{2\beta_2}$.

- If $\beta_1 < 0 \quad and \quad \beta_2 > 0$, we can calculate the threshold at which public spending can have a positive effect on economic growth. The threshold at which public spending can affect economic growth is given by:

  $\frac{\partial(TCPIB_t)}{\partial(DG_t)} \geq 0 \quad \Rightarrow \quad \beta_1 + 2\beta_2 DG_t \geq 0$; we will have from this relation: $DG_t \geq -\frac{\beta_1}{2\beta_2}$

- If $\beta_1 < 0 \quad and \quad \beta_2 < 0$, then, public spending influences economic growth negatively as its volume increases. Here too, we cannot determine the threshold since the two coefficients have the same sign.

The same procedure is used for the public investment expenditure *DI* variable and public consumption expenditure *DF* variable as far as the determination of threshold is concerned.

Appendix 3: Descriptive statistics

Case of Cameroon

	TCPIB	DG	DI	DF	TRADE	TSP	ICRG
Mean	3.896250	15.37455	4.256412	11.11814	48.72762	95.32911	0.434524
Median	4.364585	14.53947	4.149354	11.15811	49.85596	97.49366	0.451389
Maximum	22.00300	23.56001	11.40519	14.39682	65.02459	117.1339	0.583333
Minimum	-7.932067	12.15106	1.054832	8.837744	26.45271	73.38244	0.305556
Std. Dev.	5.901809	2.464818	2.326059	1.232703	8.832733	9.997007	0.088836
Skewness	0.400021	1.276519	1.150487	0.110114	-0.317765	-0.121983	0.089413
Kurtosis	4.462670	4.867776	4.599287	2.957530	2.774347	2.773778	1.792672
Jarque-Bera	4.864071	17.51154	13.74135	0.088032	0.795929	0.193717	2.606833
Probability	0.087858	0.000158	0.001038	0.956939	0.671686	0.907684	0.271602
Sum	163.6425	645.7311	178.7693	466.9618	2046.560	4003.823	18.25000
Sum Sq. Dev.	1428.085	249.0884	221.8326	62.30184	3198.704	4097.546	0.323563
Observations	42	42	42	42	42	42	42

Case of CAR (Central African Republic)

	TCPIB	DG	DI	DF	TRADE	TSP	IRP
Mean	0.832650	17.50513	4.716508	12.78862	46.26035	74.28386	5.595238
Median	2.550383	18.93577	4.817171	14.04524	46.02711	71.26518	6.000000
Maximum	9.481727	24.96441	7.767470	17.46319	66.30233	93.45573	7.000000
Minimum	-36.69995	8.394737	0.545993	6.364768	33.20967	56.94790	3.000000
Std. Dev.	7.167200	4.662483	2.129990	3.657660	9.198370	10.19281	1.498935
Skewness	-3.529779	-0.274169	-0.316525	-0.464408	0.290212	0.808695	-0.691624
Kurtosis	19.04193	1.722608	2.017519	1.695015	2.022725	2.603776	2.130971
Jarque-Bera	537.5666	3.381708	2.390535	4.489945	2.260929	4.852652	4.670028
Probability	0.000000	0.184362	0.302623	0.105930	0.322883	0.088361	0.096809
Sum	34.97130	735.2154	198.0933	537.1220	1942.935	3119.922	235.0000
Sum Sq. Dev.	2106.119	891.2885	186.0112	548.5174	3469.010	4259.627	92.11905
Observations	42	42	42	42	42	42	42

Case of Congo

	TCPIB	DG	DI	DF	TRADE	TSP	ICRG
Mean	3.930393	30.10699	12.75591	17.35108	119.0542	116.9072	0.346010
Median	3.607092	28.25194	9.883910	16.71076	126.1112	116.5834	0.361111
Maximum	23.59770	58.00774	44.51483	27.74034	165.6459	136.6200	0.416667
Minimum	-8.953428	18.52118	0.759918	9.986844	57.14071	59.38988	0.277778
Std. Dev.	6.075558	8.874649	9.701413	4.602355	26.07543	14.44504	0.039734
Skewness	0.878752	1.011500	1.165451	0.645959	-0.619727	-1.601872	-0.202939
Kurtosis	5.093940	3.773673	4.277506	2.717634	2.579127	7.260915	2.222444
Jarque-Bera	13.07846	8.209417	12.36396	3.060371	2.998412	49.73391	1.346327
Probability	0.001446	0.016495	0.002066	0.216495	0.223307	0.000000	0.510092
Sum	165.0765	1264.493	535.7481	728.7454	5000.276	4910.102	14.53241
Sum Sq. Dev.	1513.409	3229.135	3858.814	868.4484	27877.05	8555.031	0.064732
Observations	42	42	42	42	42	42	42

Case of Chad

	TCPIB	DG	DI	DF	TRADE	TSP	SD	IRP
Mean	4.625977	15.37081	4.420997	8.949812	58.99857	58.42580	1.031043	6.523810
Median	3.744598	16.25310	5.825504	7.649244	50.74811	52.40126	0.856990	7.000000
Maximum	33.62937	21.68665	12.48529	17.85866	126.3508	101.4041	4.422683	7.000000
Minimum	-21.44109	7.398030	1.665753	4.157404	20.05680	32.32816	0.136327	6.000000
Std. Dev.	9.389099	3.784584	3.065558	3.866387	21.77404	21.92450	0.732627	0.505487
Skewness	0.160187	-0.437868	0.296133	1.057303	0.930604	0.526371	2.509799	-0.095346
Kurtosis	4.991323	2.410947	1.904223	3.013295	3.575384	2.044022	11.97091	1.009091
Jarque-Bera	7.119014	1.949317	2.715134	7.825534	6.641539	3.538782	184.9288	7.000145
Probability	0.028453	0.377321	0.257286	0.019985	0.036125	0.170437	0.000000	0.030195
Sum	194.2910	645.5740	269.6819	375.8921	2477.940	2453.884	43.30383	274.0000
Sum Sq. Dev.	3614.362	587.2462	385.3034	612.9068	19438.46	19708.03	22.00644	10.47619
Observations	42	42	42	42	42	42	42	42

Case of Equatorial Guinea

	TCPIB	DG	DI	DF	TRADE	TSP	IRP
Mean	14.20940	66.91139	46.45756	20.45384	229.8176	142.3044	6.928571
Median	5.709779	63.13118	43.55448	16.62205	209.9904	112.0801	7.000000
Maximum	149.9730	165.7350	120.1055	84.50807	531.7374	650.9118	7.000000
Minimum	-9.028392	13.02591	3.763104	2.736065	93.79353	79.12032	6.000000
Std. Dev.	26.87378	35.47871	29.43812	16.76368	118.3740	96.62341	0.260661
Skewness	3.448225	0.646575	0.778595	2.197311	0.785756	3.913790	-3.328201
Kurtosis	17.00907	2.937238	3.019480	8.124805	2.799180	20.16115	12.07692
Jarque-Bera	426.6764	2.933311	4.244138	79.75860	4.392458	622.6083	221.7219
Probability	0.000000	0.230696	0.119784	0.000000	0.111222	0.000000	0.000000
Sum	596.7946	2810.279	1951.217	859.0612	9652.340	5976.786	291.0000
Sum Sq. Dev.	29610.21	51608.30	35530.72	11521.86	574508.4	382779.5	2.785714
Observations	42	42	42	42	42	42	42

Case of Gabon

	TCPIB	DG	DI	DF	TRADE	TSP	ICRG
Mean	2.460903	23.51168	8.711394	14.80029	90.72066	143.1316	0.403687
Median	3.551441	21.70998	6.025651	14.24664	90.19701	142.0848	0.388889
Maximum	35.62534	47.97664	37.40787	25.78264	119.8534	148.5888	0.527778
Minimum	-24.04921	12.47206	1.926276	9.560085	68.15384	135.9690	0.305556
Std. Dev.	9.010034	7.465521	7.119506	3.323186	10.47471	2.995932	0.056221
Skewness	0.374982	1.535344	2.360715	1.456723	0.251638	-0.034631	0.251630
Kurtosis	7.651213	5.316443	9.008351	5.623524	3.115462	2.747855	2.183465
Jarque-Bera	38.84340	25.89130	102.1863	26.89932	0.466581	0.119655	1.609998
Probability	0.000000	0.000002	0.000000	0.000001	0.791923	0.941927	0.447088
Sum	103.3579	987.4905	365.8786	621.6120	3810.268	6011.526	16.95486
Sum Sq. Dev.	3328.409	2285.094	2078.182	452.7862	4498.500	368.0000	0.129591
Observations	42	42	42	42	42	42	42

Appendix 4: Stationarity test (unit root test)

The aim of the unit root test is to determine the order of integration. It is useful to examine the stationarity of variables in order to obtain adequate regressors. The present study uses the Augmented Dickey-Fuller (1979) test for stationarity for each of the six countries of the CEMAC subregion.

ADF Test for stationarity – Case of Central African Republic (CAR)

VARIABLES	STATIONARITY TEST (AUGMENTED DIKEY FULLER TEST)					
	LEVEL			FIRST DIFFERENCE		Integration order
	ADF VALUE	p-value	STATIONARITY	ADF VALUE	p-value	
TCPIB	-6.929946	0.0000	Yes	-	-	I(0)
DG	-2.174329	0.2183	No	-7.540364	0.0000	I(1)
DI	-3.908935	0.0044	Yes	-	-	I(0)
DF	-1.364171	0.5903	No	-6.900574	0.0000	I(1)
TRADE	-2.161307	0.2230	No	-7.760308	0.0000	I(1)
INF	-5.158286	0.0001	Yes	-	-	I(0)
TSP	-0.940054	0.7652	No	-5.780505	0.0001	I(1)
SD	-3.565344	0.0110	Yes	-	-	I(0)
IRP	-1.668078	0.4395	No	-6.426846	0.0000	I(1)

Source: Authors, based on EVIEWS 9.

ADF Test for stationarity – Case of Chad

VARIABLES	STATIONARITY TEST (AUGMENTED DIKEY FULLER TEST)					
	LEVEL			FIRST DIFFERENCE		Integration order
	ADF VALUE	p-value	STATIONARITY	ADF VALUE	p-value	
TCPIB	-5.081025	0.0001	Yes	-	-	I(0)
DG	-3.297551	0.0216	Yes	-	-	I(0)
DI	-1.990110	0.2899	No	-5.430697	0.0001	I(1)
DF	-2.336696	0.1658	No	-5.578882	0.0000	I(1)
TRADE	-1.485501	0.5306	No	-9.584624	0.0000	I(1)
INF	-5.535001	0.0000	Yes		-	I(0)
TSP	0.693858	0.9906	No	-4.095571	0.0028	I(1)
SD	-4.954592	0.0002	Yes	-	-	I(0)
IRP	-2.586576	0.1039	No	-7.348469	0.0000	I(1)

Source: Authors, based on EVIEWS 9.

ADF Test for stationarity – Case of Congo

VARIABLES	STATIONARITY TEST (AUGMENTED DIKEY FULLER TEST)					
	LEVEL			FIRST DIFFERENCE		Integration order
	ADF VALUE	p-value	STATIONARITY			
TCPIB	-1.948142	0.3078	No	-7.869109	0.0000	I(1)
DG	-2.811240	0.0655	Yes		0.0000	I(1)
DI	-2.330428	0.1676	No	-5.341032	0.0000	I(1)
DF	-2.816607	0.0647	Yes			I(0)
TRADE	-1.986210	0.2915	No	-6.100818	0.0000	I(1)
INF	-6.092344	0.0001	Yes	-	-	I(0)
TSP	-1.948142	0.3078	No	-6.049713	0.0000	I(1)
SD	-1.680045	0.4334	No	-10.07068	0.0000	I(1)
IRP	-2.574880	0.1063	No	-6.513466	0.0000	I(1)
ICRG	-0.053771	0.9474	No	-7.664281	0.0000	I(1)

Source: Authors, based on EVIEWS 9.

ADF Test for stationarity – Case of Cameroon

VARIABLES	STATIONARITY TEST (AUGMENTED DIKEY FULLER TEST)					
	LEVEL			FIRST DIFFERENCE		Integration order
	ADF VALUE	p-value	STATIONARITY			
TCPIB	- 4.491258	0.0008	Yes	-	-	I(0)
DG	-2.072490	0.2564	No	-5.930532	0.0000	I(1)
DI	-2.259059	0.1898	No	-4.861905	0.0003	I(1)
DF	-2.297656	0.1775	No	-7.530143	0.0000	I(1)
TRADE	-2.490704	0.1250	No	-6.798466	0.0000	I(0)
INF	-4.953310	0.0002	Yes	-	-	I(0)
TSP	-0.07665	0.9452	No	-5.010991	0.0008	I(1)
SD	-1.964022	0.3010	No	-7.564029	0.0000	I(1)
IRP	-2.848991	0.0604	Yes	-	-	I(0)
ICRG	-1.688289	0.4293	No	-4.287719	0.0016	I(1)
TSS	-1.074886	0.7045	No	-3.657965	0.0215	I(1)

Source: Authors, based on EVIEWS 9

ADF Test for stationarity – Case of Equatorial Guinea

VARIABLES	STATIONARITY TEST (AUGMENTED DIKEY FULLER TEST)					
	LEVEL			FIRST DIFFERENCE		Integration order
	ADF VALUE	p-value	STATIONARITY	ADF VALUE	p-value	
TCPIB	-3.929693	0.0042	Yes	-	-	I(0)
DG	-2.910930	0.0527	Yes	-	-	I(0)
DI	-3.376625	0.0177	Yes	-	-	I(0)
DF	-2.776452	0.0705	Yes	-	-	I(0)
TRADE	-2.003040	0.2845	No	-6.397481	0.0000	I(1)
INF	-5.189650	0.0001	Yes	-	-	I(0)
TSP	-3.926915	0.0042	Yes	-	-	I(0)
IRP	-5.634387	0.0000	Yes	-	-	I(0)

Source: Authors, based on EVIEWS 9.

ADF Test for stationarity – Case of Gabon

VARIABLES	STATIONARITY TEST (AUGMENTED DIKEY FULLER TEST)					
	LEVEL			FIRST DIFFERENCE		Integration order
	ADF VALUE	p-value	STATIONARITY	ADF VALUE	p-value	
TCPIB	-5.665414	0.0000	Yes	-	-	I(0)
DG	-3.126663	0.0323	Yes	-	-	I(0)
DI	-3.413131	0.0161	Yes	-	-	I(0)
DF	-2.903914	0.0536	Yes	-	-	I(0)
TRADE	-2.577725	0.1057	No	-9.127536	0.0000	I(1)
INF	-6.090624	0.0000	Yes	-	-	I(0)
TSP	-3.86278	0.0050	Yes	-	-	I(0)
SD	-4.060724	0.0029	Yes	-	-	I(0)
IRP	-2.001879	0.2849	No	-6.164414	0.0000	I(1)
ICRG	-1.862674	0.3461	No	-6.546298	0.0000	I(1)

Source: Authors, based on EVIEWS 9.

The stationarity test via the Augmented Dickey Fuller test shows that some variables are integrates at the level (I(0)), while others are integrated in first difference (I(1)). Hence, the conditions for the use of ARDL model are satisfied. That is, in this situation, the ARDL bounds test can be performed in order to see if the short-run and the long-run relationships exist.

Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

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