

# Effect of Deficit of budget balance on Private Investment in CEMAC?

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## Research Article

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### **Abstract**

This paper aims to determine the impact of the deficit of budget balance on private investment in CEMAC over the period 1984-2019. To this end, the PMG model and the regime-switching model were mobilized to check the linear or non-linear relationship that may exist between the variables involved. At the end of the PMG estimate, it appears that the negative and significant effects of the deficit of budget balance on private investment are not isolated, but depend heavily on its interaction with long-term domestic public debt. Given the non-linear nature of the relationship between deficit of budget balance and private investment, using Hansen's (1999) regime-switching model revealed that there are thresholds for which deficit of budget balance has positive and significant effects on private investment in each CEMAC country. By ricochet, maintaining a sustainable level, the private sector would become the real incubator of the development process in the states.

**Keywords:** Fiscal Deficit, Public Debt, Private Investment, CEMAC.

**JEL Code:** H62, H63, R42

## **1. Introduction**

Persistent government deficit of budget balance, rising public debt, and improving conditions for private sector actors are concerns of economists. Given this situation, several theoretical developments and empirical studies have examined the relationship between the deficit of budget balance and macroeconomic variables (Saleh, 2003). Classical and neoclassical economists share the common belief that deficit of budget balance affect the general functioning of the economy. Easterly and Rebelo (1993) argue that deficit of budget balance have been blamed for the recession in both developing and developed countries. According to this, deficit of budget balance lead to over-indebtedness, high inflation, low investment, and, as a result, a decline in economic growth. Furthermore, Premchand (1984) argues that financing the deficit of budget balance through public loans implies an increase in the supply of government bonds. By attracting buyers to these government bonds, the state presents them at a relatively low price, which leads to an increase in interest rates, which in turn increases private bonds and thus worsens private investment. State measures thus contribute to the financial crowding out of the private sector. The negative relationship is in line with the conventional view of debt (Elmendorf & Gregory Mankiw, 1998) that private investment is crowded out when the economy faces a high debt problem (Bahal, Raissi & Tulin, 2018; Chudik, Mohaddes, Hashem & Raissi, 2017; De Vita, Trachanas & Luo, 2018; Kim, Ha & Kim, 2017; Shahor, 2018).

According to Pegkas (2019) and Ewaida (2017), the financing of public sector investments, whether through government revenue, debt issuance, or inflation, worsens the resources available to the private sector and slows down the private sector investments. At the same time, they show that public investment in transport and communications, or the provision of public goods and services, clearly creates an environment for private investment and that investment increases the expansion of private investment.

However, there is a notable difference between modern investment theory and the models chosen by developing countries. This difference results from a variety of causes, both analytical and pragmatic. These causes include the institutional and structural factors that exist in most developing countries, such as the absence of well-functioning financial markets, adequate government participation in capital formation, distortions due to exchange rate restrictions, etc. In most developing countries, bank credit flows have been at the private sector are the major source of finance for the private sector. Analysis of data from business

surveys for CEMAC, Fiess, and Kouevi (2018) found that more than half of the companies surveyed in CEMAC identified electricity shortages, unfair competition in the informal sector, and corruption as the major restrictions on doing business in the CEMAC region. At the country level, access to finance (Cameroon, Central African Republic), political instability (Republic of the Congo, Chad), transport (Gabon), and an insufficiently skilled workforce (Gabon) are also among the top three constraints to doing business.

Also, the public debt of the CEMAC countries has increased significantly since 2014. In fact, it rose from 22% of GDP at the end of 2013 to 50.4% of GDP at the end of 2016. It exceeded 100% of GDP in the Congo and 50% of GDP in three other countries (Gabon, Central African Republic, and Chad). This increase is much larger than that foreseen at the time of the regional consultations in 2014, as the debt-to-GDP ratio is only expected to increase by 4 percentage points over this period. There are three reasons for this: an unexpectedly low budget balance, as lower oil revenues were only partially offset by lower domestically funded spending; an above-expected interest rate gap with growth due to higher interest payments and lower growth; and non-budgetary factors that are not reflected in the core fiscal balance. It is important to note that the latter did not include an increase in externally funded expenditure as it was lower than expected.

In 2015, when states faced greater funding needs and liquidity tensions, the BEAC abandoned its policy of phasing out credits granted to states and reinstated statutory advances at their statutory level (20% of the previous year's budget revenue), thereby reducing the proportion of domestic resources in the budgetary envelope. This adjustment policy contributed to a significant widening of the current account deficit, which together with the decline in net capital flows and external debt in 2017 led to a sharp drop in reserves of 12.8 billion euros compared to 4.7 billion euros at the end of 2016. As a result, private investment declined. Also, the Bank of Central African States (BEAC) notes that the budget deficit has decreased significantly from 4.8% of GDP in 2017 to 0.5% of GDP in 2018 and the current external deficit dropped from 6.4% of GDP in 2017 to 3.4% in 2018.

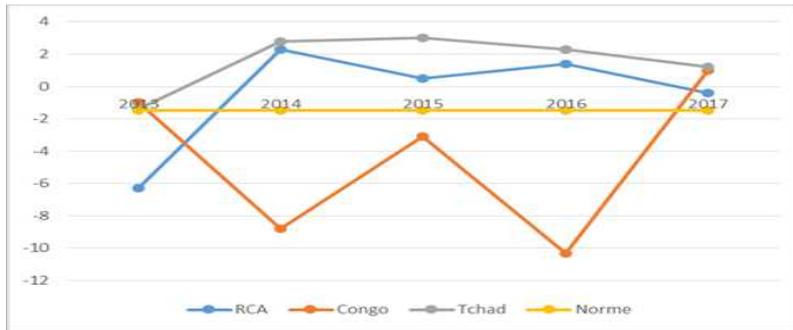
Some recent studies have analyzed the relationship between debt and investment (Hakimi et al. 2019; Omodero 2019; Njamen et al. 2020); and for the majority of them, the relationship is either positive or negative, reflecting the nonlinear relationship (Tafah et al. 2012; Sharafat, 2013; Apere, 2014; Popov and Barbiero, 2018; Agyapong, 2020). Other empirical studies focused on the impact of public debt on economic growth, focusing on mixed economies and high-income economies (Butkus & Seputiene, 2018; Liaqat, 2019; Gomez-Puig and Sosvilla-Rivero, 2018a; Liaqat, 2019). Ogunjimi (2019) examines the impact of public debt financing public deficit on investment in Nigeria from 1981-2016. The results indicate that domestic debt improves both private and public investment in the short and long-run. The results also showed that external debt is crowding out private investment and public investment in Nigeria. Some studies focus on the negative impact of debt on investment (Kamgnia and Touna, 2002; Hakimi et al. 2019; Omodero, 2019). In most of the papers, however, the relationship is rather positive and is reflected in a non-linear relationship (Tafah et al. 2012; Sharafat, 2013; Apere, 2014; Popov and Barbiero, 2018; Agyapong, 2020). Our research differs from this work in two aspects: firstly, the determination of the interaction effect of the deficit of budget balance with external and internal debt on private investment; second, by finding the threshold effect of the deficit of budget balance on private investment in each CEMAC country.

The rest of the article is organized as follows: Section 2 contains the stylized facts, Section 3 summarizes the empirical literature on the relationship between deficit of budget balance, public debt, and private investment, Section 4 describes the data, the choice of variables, and the methodology, Section 5 presents and interprets the estimation results and Section 6 concludes with policy implications.

## 2. Stylized facts

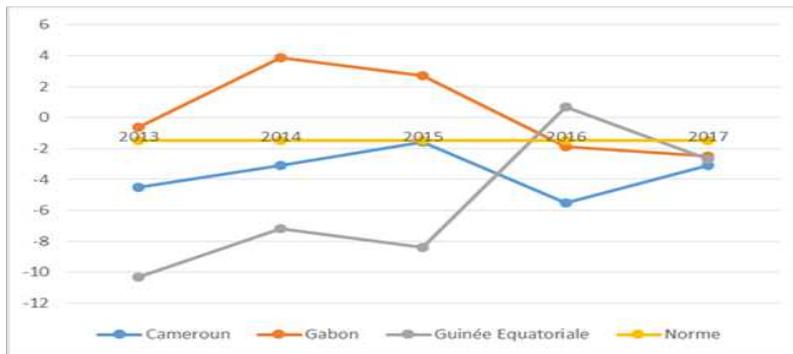
### 2.1. Trends in the fiscal balance of CEMAC countries compared to the baseline

The subtle information that emerges from Fig. 1 and 2 below is that the Central African Republic, Congo, and Chad failed to reach the benchmark fiscal balance ( $\geq 1.5\%$  of GDP) in 2017. Cameroon, Gabon, and Equatorial Guinea need to make even greater efforts to restore their budget accounts.



**Fig. 1.** Reference Budget Balance - CAR, Congo, and Chad

Source: 2016 Multilateral Surveillance Final Report and 2017 Outlook



**Fig. 2:** Reference Budget Balance - Cameroon, Gabon, Equatorial Guinea

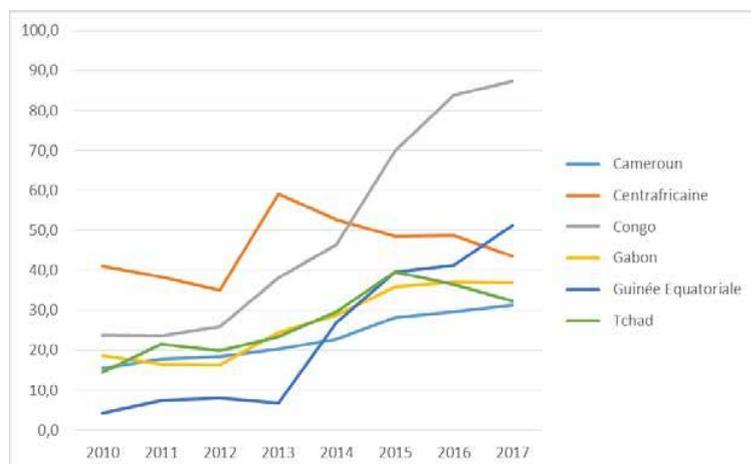
Source: Final 2016 Multilateral Monitoring Report and 2017 Outlook

Most states have resorted to central bank funding because of the decision to revert to the old statutory provision that authorizes advances not exceeding 20% of last year's budget revenues. However, it has also reached its limit on the central bank's refinancing of public securities and has exhausted its funding margin. This situation has caused states to go into debt and accumulate arrears. As a result, the new debt growth mechanism and the no arrears regime were not respected in most CEMAC countries in 2017.

### 2.2. Increase in the domestic and external debt burden of CEMAC countries

Figure 3 shows that all countries will comply with the debt ceiling standard by 2016. However, the Congo is an exception as it does not comply with it in 2017. Compared to 2010, all countries outside the Central African Republic recorded an increase in their debt. Given

the high debt margin that leaves a debt ceiling of 70%, the new multilateral surveillance framework has added an indicator of the speed of debt.



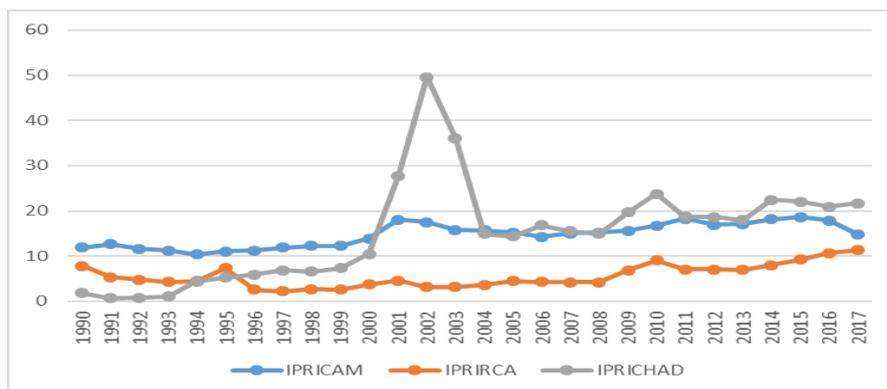
**Fig. 3.** Stock of domestic and external public debt (as % of GDP)

Source: 2016 Multilateral Surveillance Final Report and 2017 Perspectives

The most worrying aspect of the worsening fiscal balance is the accumulation of arrears, which leads to a reduction in private investment, followed by layoffs and corporate bankruptcies.

### *2.3 Evolution of private investment in CEMAC countries*

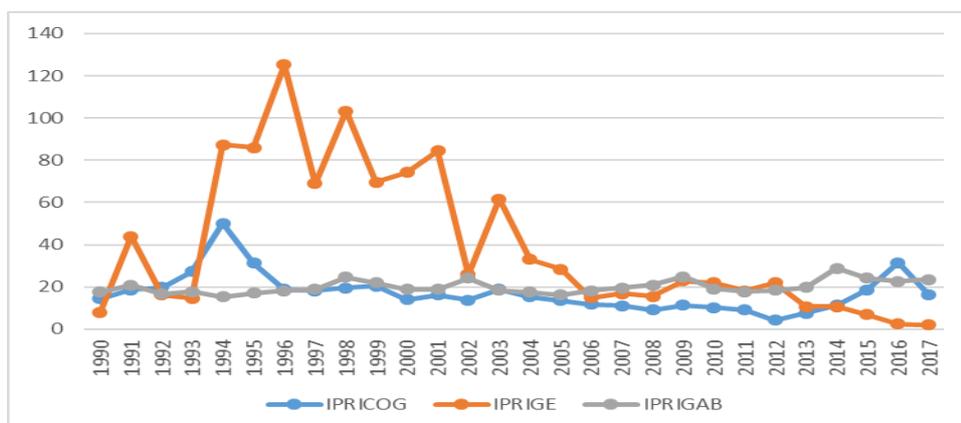
As shown in Figure 4 opposite, the trend in private investment was not the same in all CEMAC countries, but the factors behind its fluctuation towards the end of the period seem to be common. If we first look at the Cameroon case, private investment has increased since 1990, peaking at 18% in 2001. This growth is due to the purchase of intermediate, capital, and construction goods. After that, it decreased slightly between 2001 and 2008. Then the investment rate rose from 15.6% in 2009 to 16.7% in 2010. After a brief period of stability from 2013 to 2015, it was 14.8% in 2017 compared to 17.9% in 2016, a decrease of 3,1%. In the Central African Republic, the share of private investment in real GDP was 7.8% in 1990. After that, in 1995 it only reached an approximate percentage (7.4%). Between 1996 and 2008, economic activity showed inertia, but it has started to recover from 2012, with private investment rising to 11.3% in 2017. This representation of three countries in Figure 4 shows not only the Chadian economy with the lowest private investment rates (0.66% in 1991) but also the highest (49.5% in 2002). After 2002, private investment declined until 2004. There were only minor fluctuations between 2005 and the end of the reporting period. However, we note that 2010 and 2014 are the only years when the share of private investment in GDP approaches 23%.



**Fig. 4.** The percentage share of private investment in GDP-Cameroon, CAR, Chad  
 Source: Authors, based on World Bank data (2017)

Figure 5 below shows the evolution of private investment in the other three countries, namely Equatorial Guinea, Congo, and Gabon. In the period 1990-2004, private investment in Equatorial Guinea was volatile. The highest peaks between 1996 and 1998 were 125% and 103%, respectively. This increase in private investment, combined with the help of bilateral and multilateral donors (European countries, USA, World Bank) has enabled the state to promote a favorable framework for the business climate in the economy. The 1994 devaluation reinforced this trend. Also, the contribution of private investment has declined since 2004 despite the good performance so far. The decline is in a row through 2017, when it hits its lowest point (1.97% of GDP). In the Congo, private investment growth began in 1990 and peaked at 50% in 1994. After that date, it declines to hit a 4.2% threshold in 2012. Then it resumes a timid evolution that allows it to approach the 31% rate in 2016. Then it drops by half and reaches 16% in 2017. Gabon, unlike Equatorial Guinea and Congo, there appear to be only minor fluctuations over the entire period. The highest level of 28.9% will be reached in 2014. After that, private investment will decline until 2017.

From all these analyzes, it emerges that all the CEMAC countries, namely CAR, Congo, Cameroon, Chad, Equatorial Guinea, and Gabon, again saw a decline in private investment in 2014 due to their apparent deficit of budget balance and the difficulties facing the public authorities of the various states Maintaining the public accounts. Also, the level of private investment is determined by the size of the deficit. In the Congo, for example, private investment fell by -15.4% in 2017 compared to 2016.



**Fig 5.** Share of private investment in GDP in percentage-Congo, Equatorial Guinea, Gabon  
 Source: Author, based on World Bank data (2017)

### 3. Review of the empirical literature

If, in theory, the Classics and Keynesians defend opposing ideologies regarding the budget deficit, there is also disagreement among economists at the empirical level. Kibet (2013) examined the effects of the budget deficit and corruption on private investment in developing countries in the period 1984-2010 using panel data from 70 countries. The methodology used was the Generalized Method of Moments (GMM) to address the problem of endogeneity. This work shows that the budget deficit-corruption interaction is associated with lower private investment. Even if other explanatory variables are included in the model, the crowding out effect of the budget deficit is still considered. Also, a high level of corruption is associated with a lower level of investment. Also, Madni (2013) examined the role of fiscal policy for private investment in Pakistan between 1979 and 2012. After making his estimate using the Error Correction Model (ECM) applied to the short-term dynamics, he shows that the budget deficit interest rate, Inflation, and external debt correlate negatively with private investment, while the exchange rate and exports have had a positive impact.

Similarly, Alberto (2012) examined the impact of the state budget deficit on the evolution of private sector investment in Saudi Arabia. This study found a crowding-out effect of private investment by the state budget deficit. The study suggests that domestic borrowing financing the budget deficit reduces the resources available in financial markets for the private sector, thereby hindering private sector investment. An important limitation of its work is that it focuses only on tax revenue and domestic public debt as the primary means of deficit financing, which is wrongly considered in developing countries.

Antonio and Tovar (2011) assess the influence of fiscal components on private investments using panel data from 95 countries for the period 1970 to 2008. Their results show a positive effect of total government expenditure, mainly public investments, on the promotion of private investments. However, current public spending has a negative impact on private investment. Debt interest payments and subsidies have a negative impact as they reduce both public and private investment.

Emad and Abdullatif (2006) examined the relationship between the budget deficit and private sector investment through government spending financed by government bonds in the Japanese economy. This study shows that deficit financing through bond issuance does not displace private sector investment, but has positive effects. The government can sell them on the domestic and international financial markets through increasing bond issues. The implementation of this method does not influence the interest rates, as they are insensitive to public expenditure, as they depend more on the interest rate level on the international financial market than on the domestic market due to globalization and integration into the financial markets.

Fredrick and Okeke (2013) assessed the impact of the budget deficit on private investment using ordinary least squares and the Granger causality test. The result is that the budget deficit is crowding out private investment in Nigeria and, also, private investment is causing the budget deficit with feedback effects. So they suggest that the government reduce current spending and increase capital spending to create an environment for private investment. Similar to these efforts, Isah (2012) examines the impact of government expenditure on private investment between 1990 and 2007 in his study of the type of deficit financing and its impact on private investment in Nigeria. The results show that deficit financing is through domestic borrowing during the revised period crowding out private investment. Therefore, it recommends that the government realign its fiscal policy in favor of the private sector by limiting spending and maintaining a low budget deficit to avoid crowding out.

In this sense, Vincent and Clem (2013), after analyzing the annual data over a period of 37 years, found that there was a positive long-term relationship between the budget deficit,

private investment, and the real growth of the economy (1970 to 2006). Examination of the results showed that a 1% increase in the budget deficit leads to a 0.267% increase in private investment. To do this, they propose that the state increase spending on infrastructure and lower current spending, as this will help build human capital. Government programs should also be funded through the bond market so that funds and savings can be mobilized and then used for specific projects.

Tank (2014), who applied the instrumental variable method for a 31-year sample (1981-2012) to the Nigerian economy, found that there was a linear and positive relationship between the budget deficit and private investment. Public external debt, however, has a U-shaped impact on private investment and private consumer spending. Also, real GDP has a negative impact on private sector investment. He concludes that Nigeria could benefit from external debt if the funds borrowed were high enough relative to GDP and invested in productive businesses.

Few recent studies have specifically looked at the impact of the budget deficit on private investment. Indeed, little work has focused on the impact of the budget deficit-public debt interaction (domestic and external) on private investment on the one hand and setting thresholds for fiscal sustainability at the level of each CEMAC country on the other.

## 4. Data, Variable choice, and Methodology

### 4.1. Data

The data used in this analysis comes from secondary sources and comes mainly from the macroeconomic databases BEAC (2019), the International Country Risk Guide (ICRG, 2019), and the World Bank's annual publication in World Development Indicators, which is contained in the CD-Rom (WDI) are included, (2019) and cover the period from 1984 to 2019. This investigation period is justified because data on institutes in the ICRG is largely only available since 1984. The explanatory variables identified in the analysis are socio-macroeconomic variables derived from the literature. This is the GDP Gap (OutGap) calculated from World Bank GDP data (WDI, 2019). The same applies to data on real private investment (Priv) and government consumption expenditure (GCP). The political risk (PolRisk) variable used to measure the quality of institutions in the countries concerned comes from the International Country Risk Guide (ICRG, 2019). The structural budget balance (SOBS) is calculated using data on the total or actual budget balance from the BEAC (2019). To complete the missing data on domestic public debt in some countries in our sample, we have subtracted from the overall public debt the external public debt ( $InDebt = GlobDebt - ExDebt$ ).

### 4.2. Presentation of variables

The variables involved in this study can be grouped into two categories: variables of interest and control variables.

Variables of interest are those that contribute significantly to the verification of the specific hypotheses of the study. We have a real private investment (*Priv*), which is an explained variable representing a proxy for private sector Gross Fixed Capital Formation (GFCF). To consider the constraint imposed by public debt on the orientation of a country's fiscal policy, we integrate two debt variables, namely: domestic public debt (*InDebt*) and external public debt (*ExDebt*). Indeed, external debt makes it possible to evaluate the weight of debt service on the budget deficit and therefore on private investment. Domestic debt measures the effect of the decrease in domestic savings on the promotion of the individual

initiative. Also, we use the real structural budget balance variable (SOBS), which is a measure of the budget deficit. Statistically, the structural balance is determined by the difference between the actual balance and its cyclical component:

$$SOB_{structural} = SOB_{observed} - SOB_{cyclical} \quad (1)$$

The structural budget balance, where it does not depend on economic fluctuations, is often used as an indicator of fiscal adjustment. In fact, it is more important than the cyclical balance and better reflect changes in the actual balance (Poumie and Ngouhouo, 2018). Also, changes in the structural balance give us the direction and impetus adopted by the government. Thus, the structural budget balance we use here will be the residual of estimate (2) below:

$$SOBS_{it} = \alpha OutGap_{it} + \mu_{it} \quad (2)$$

In this formulation, the variable  $OutGap_{it}$  measures the cyclical deviation of GDP from its trend. It makes it possible to assess the *output gap*, which is a fundamental indicator for the approximation of the productive capacity utilization rate. To have comparable data over a considerable period, we have calculated the output gap using the Hodrick-Prescott filter applied to GDP. Its coefficient ( $\alpha$ ) is used to assess the cyclicity of fiscal policy. In fact, a pro-cyclical fiscal policy is evident if the coefficient of this variable is negative; otherwise, fiscal policy is countercyclical. However, the coefficient must be significant, otherwise fiscal policy is acyclical. It is calculated as the deviation of constant local currency GDP from its trend level:

$$(OutGap_{it} = \frac{GDP_{it} - GDP_{it}^{trend}}{GDP_{it}^{trend}}) \quad (3)$$

Hodrick-Prescott's smoothing (1980) is also regularly used by the European Commission, which prefers it to methods based on the estimation of a production function (Bouthevillain et al., 2001). It eliminates the inertia of a stochastic trend component over time and is independent of the cyclical component. As a smoothing parameter, we used 100 as recommended by the Hodrick-Prescott (1980) filter because our data are annual.

The control variables are socio-macroeconomic variables from the literature. They improve the explanatory scope of the analysis models selected by integrating the impact of factors related to the socio-economic environment on the variable under study. We have:

- The Political Risk (*PolRisk*) Index: This is an institutional indicator ranging from 0 to 100 and composed of 12 factors. It reflects government stability, socioeconomic conditions, investment profile, internal and external conflicts, corruption, military involvement in politics, religious tensions, respect for legal texts and laws, ethnic tensions, the conduct of democracy, and the quality of the bureaucracy. This indicator is constructed from a weighting of scores ranging from 0 to 4, 6 or 12 points maximum depending on the risk factors considered. The arithmetic total of the scores of the different factors constitutes the perception of the level of the political risk index of the country under consideration. The higher the total points in a country the lower the political risk. This variable proves to be very important in the relationship's analysis between the budget deficit and private investment. The expected sign is ambiguous.

- The Consumer Price Index (CPI): It measures the level of inflation in the economy. In other words, it considers the effect of price changes on the deterioration of the purchasing power of residents and its effect on the size of the market. A sharp rise in the general price level may lead the central bank to increase its key rate, thus increasing the cost of borrowing and reducing private investment. The expected sign of this variable is indeterminate since the

value of its parameter depends on relative changes in the supply of money, the demand for money, and the supply shock. Some empirical studies have highlighted the existence of a threshold effect. Thus, Sarel (1996) showed, based on a sample of 87 countries at different levels of development, that inflation has a negative effect on economic activity when it is greater than or equal to 8%. In both cases, the effects can be positive in the short term and negative beyond a certain threshold in the long term. The table 1 in appendix below summarizes the variables, their measurement, and the expected theoretical signs.

### 4.3. Methodology

Drawing on the empirical literature, the link between the budget deficit, public debt, and private investment in the CEMAC zone will be tested using a linear and a non-linear model.

#### 4.3.1. Linear model

The basic model comes from the studies of Mwigeka (2016) who assessed the effects of the budget deficit on private investment in Tanzania. His analysis is an extension of that of Blanchard and Perotti (2002). We incorporate additional variables, namely, public debt (external and domestic), the output gap, and the institutional variable political risk. Also, we consider the role of interactive variables in this analysis. These are the interaction between the *output gap* and the structural budget balance (*Outgap \* SOBS*) then, between the structural budget balance and the public debt (internal and external) specified respectively by the variables *Outgap \* InDebt* and *Outgap \* ExDebt*. We have the following function:

$$Priv_{it} = f(OutGap, SOBS, InDebt, ExDebt, CPI, PolRisk) \quad (4)$$

The basic model is written in the following linear form:

$$Priv_{it} = \beta_0 + \beta_1 SOBS_{it} + \beta_2 InDebt_{it} + \beta_3 ExDebt_{it} + \beta_4 X_{it} + \varepsilon_{it} \quad (5)$$

In equation (5),  $Priv_{it}$  is the Gross Fixed Capital Formation for the Private Sector representing the private investment of country  $i$  at time  $t$ ,  $SOBS_{it}$ , the budget deficit representing the structural budget balance, and  $X_{it}$  stands for a set of control variables, and  $\varepsilon_{it}$  is the error term. Traditional estimation methods used to estimate Equation (5) do not allow us to capture the potential budget deficit adjustment dynamic (Campos and Kinoshita, 2008; Baltagi, 2008). So, this paper investigates the dynamic link between budget deficit, public debt, and private investment by using the PMG (Pooled Mean Grouped) specification of Pesaran et al. (2001).

$$\Delta y_{it} = \phi_i (y_{it-1} - \theta_i' X_{it}) + \sum_{j=1}^{p-1} \gamma_{ij}^* \Delta y_{it-j} + \sum_{j=1}^{q-1} \lambda_{ij}^* \Delta X_{it-j} + \mu_i + \varepsilon_{it} \quad (6)$$

Where  $\phi_i$  is the adjustment coefficient (assumed to be negative),  $\theta_i$  is the vector of long-term coefficients, and  $\Delta$  refers to the variation between two given dates.  $X_{it}$  is the vector of explanatory variables,  $\mu_i$  designates fixed effects. The number of groups is  $i=1, 2, 3, \dots, N$ ; the number of periods is  $t=1, 2, 3, \dots, T$ .  $\lambda_{ij}$  is a scalar, and  $\delta_{ij}$  is the vector of coefficients. If the variables of the model (5) are stationary of order  $I(1)$  and cointegrated, then the error term  $\varepsilon_{it}$  is stationary of order  $I(0)$  for all individuals in the panel. The major interest in having cointegrated variables lies in their capacity to react to any deviation from the long-term

equilibrium. Model (5) can therefore be rewritten as an error-correction model, in which the short-term dynamics of the variables are influenced by the deviation from the long-term equilibrium.

From this *PMG* (Pool Mean Grouped) formulation, it will be possible to estimate the short- and long-term models jointly. Moreover, there will be no difficulty in considering both stationary variables in  $I(0)$  and  $I(1)$  or co-integrated variables (Pesaran and Shin, 1999). In passing, it should be noted that the values of  $p$  and  $q$  that indicate the number of lags in the model are determined by the Schwartz Information Criterion (SIC). Thus, for an ARDL model  $(p, q, q, \dots, q, q)$ , we obtain:

$$\begin{aligned} \Delta \text{Pr} iv_{it} &= \phi_i (\text{Pr} iv_{it-1} - \phi_1' \text{OutGap}_{it} - \phi_2' \text{SOBS}_{it} - \phi_3' \text{InDebt}_{it} - \phi_4' \text{ExDebt}_{it} - \phi_5' \text{CPI}_{it} - \phi_6' \text{PolRisk}_{it}) \\ &+ \sum_{j=1}^{p-1} \gamma_{ij}^* \Delta \text{Pr} iv_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{OutGap}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{SOBS}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{InDebt}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{ExDebt}_{it-j} \\ &+ \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{CPI}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{PolRisk}_{it-j} + \mu_i + \varepsilon_{it} \end{aligned} \quad (7)$$

Considering the interaction between the budget balance, the output gap, and public debt (external and internal) makes it possible to assess the marginal effects of the budget balance on private investment. We have respectively:

$$\begin{aligned} \Delta \text{Pr} iv_{it} &= \phi_i (\text{Pr} iv_{it-1} - \phi_1' \text{OutGap}_{it} - \phi_2' \text{SOBS}_{it} - \phi_3' \text{InDebt}_{it} - \phi_4' \text{ExDebt}_{it} - \phi_5' \text{CPI}_{it} - \phi_6' \text{PolRisk}_{it}) \\ &+ \sum_{j=1}^{p-1} \gamma_{ij}^* \Delta \text{Pr} iv_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{Outgap}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{SOBS}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{InDebt}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{ExDebt}_{it-j} \\ &+ \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{CPI}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{PolRisk}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta (\text{OutGap}_{it-j} * \text{SOBS}_{it-j}) + \mu_i + \varepsilon_{it} \end{aligned} \quad (8)$$

$$\begin{aligned} \Delta \text{Pr} iv_{it} &= \phi_i (\text{Pr} iv_{it-1} - \phi_1' \text{OutGap}_{it} - \phi_2' \text{SOBS}_{it} - \phi_3' \text{InDebt}_{it} - \phi_4' \text{ExDebt}_{it} - \phi_5' \text{CPI}_{it} - \phi_6' \text{PolRisk}_{it}) \\ &+ \sum_{j=1}^{p-1} \gamma_{ij}^* \Delta \text{Pr} iv_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{gap} \text{PIB}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{SOBS}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{InDebt}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{ExDebt}_{it-j} \\ &+ \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{CPI}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{PolRisk}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^{**} \Delta (\text{SOBS}_{it-j} * \text{ExDebt}_{it-j}) + \mu_i + \varepsilon_{it} \end{aligned} \quad (9)$$

$$\begin{aligned} \Delta \text{Pr} iv_{it} &= \phi_i (\text{Pr} iv_{it-1} - \phi_1' \text{OutGap}_{it} - \phi_2' \text{SOBS}_{it} - \phi_3' \text{InDebt}_{it} - \phi_4' \text{ExDebt}_{it} - \phi_5' \text{CPI}_{it} - \phi_6' \text{PolRisk}_{it}) \\ &+ \sum_{j=1}^{p-1} \gamma_{ij}^* \Delta \text{Pr} iv_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{OutGap}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{SOBS}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{InDebt}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{ExDebt}_{it-j} \\ &+ \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{CPI}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^* \Delta \text{PolRisk}_{it-j} + \sum_{j=0}^{q-1} \lambda_{ij}^{***} \Delta (\text{SOBS}_{it-j} * \text{InDebt}_{it-j}) + \mu_i + \varepsilon_{it} \end{aligned} \quad (10)$$

Equations (8), (9), and (10) above represent respectively the interaction between the structural budget balance and *the output gap*, external public debt, and domestic public debt.

The error term  $\eta_{it} = \varepsilon_i + \pi_t + \varphi_{it}$  where  $\varepsilon_i$  means a constant term over the period depending only on the individual  $i$ ,  $\pi_t$  a term dependent only on the period  $t$ ,  $\varphi_{it}$  a cross-random term.

#### 4.3.2. Non-linear model

There is little work on taking non-linearity into account, particularly in developing countries. Non-linearity is, however, an important characteristic of the dynamics of macroeconomic aggregates and its modeling requires particular attention in the model's choice to be used. Previous studies have shown that the most fruitful path for non-linearity modeling is that of regime-switching models. The reasons for this choice are simple: besides economically explaining this non-linearity, these models also allow an economic series to have different dynamics across regimes.

In our work, we use the mechanism of the abrupt transition of Bai and Perron (2003) initially proposed by Hansen (1999). This transition is in fact used when we have an indicator function since the transition from one regime to another can take place in one period by comparing the transition to a threshold. If this variable is lower or higher than the threshold, the transition takes place instantaneously. In this model, the dependent variable is generated by two distinct processes. We are in the dynamics of one process or another according to the value taken by a variable called transition variable. Since the transition is carried out using a transition variable and an observable threshold, we take the structural budget balance as the transition variable in our specification while allowing the internal and external public debt to vary according to the different regimes of the budget balance. This formulation allows us to consider the debt constraint in the analysis.

However, we opt for a cross-sectional analysis by country in our non-linear modeling. In fact, a panel shift in a fiscal framework would imply that all CEMAC countries will change their structural budget deficit threshold at the same rate and thus that fiscal policies are perfectly harmonized. Given the current context, this assumption is unrealistic in CEMAC countries. The threshold model that we estimate can thus be written for each CEMAC country:

$$\begin{aligned} \text{Pr } iv_t = & \alpha_0 + \alpha_1 SOBS_t (SOBS < \theta) + \alpha_2 InDebt_t (SOBS < \theta) + \alpha_3 ExDebt_t (SOBS < \theta) + \alpha_4 SOBS_t I(SOBS \geq \theta) \\ & + \alpha_5 ExDebt_t I(SOBS \geq \theta) + \alpha_6 InDebt_t I(SOBS \geq \theta) + \alpha_7 Outgap_t + \alpha_8 CPI_t + \alpha_9 PolRisk_t + \pi_t \end{aligned} \quad (11)$$

Thus, testing the linearity of the model means-testing  $H_0: \alpha_1 = \alpha_4$  against  $H_1: \alpha_1 \neq \alpha_4$ . As the threshold is not defined under  $H_0$  If the value of the property is less than its estimated value, it will be considered being equal to its estimated value. It thus becomes possible to use the statistics of the usual tests such as the Fisher test specified by the relation:

$$F = \frac{S_0 - S_1(\hat{\gamma})}{\hat{\sigma}^2} \quad (12)$$

$S_0$  is the sum of the squares of the residuals of the model under the hypothesis  $H_0$  and  $S_1(\hat{\gamma})$  the sum of the squares of the residuals of the non-linear model.

However, the linearity test can also be done by squaring the structural budget balance variable. This formulation is inspired not only by the work of Furceri and Sousa (2012) but also, more recently, by that of Jérôme et al. (2015), who examined the non-linear relationship between public and private investment based on quarterly data over the period 1966 $t_1$  – 2014 $t_2$  in four OECD countries. In our case, we will have the following short-term equation (14):

$$\begin{aligned} \Delta \text{Pr } iv_{it} = & \phi_i (\text{Pr } iv_{it} - \phi_1 \text{Outgap}_{it} - \phi_2 SOBS_{it} - \phi_3 SOBS_{it}^2 - \phi_4 InDebt_{it} - \phi_5 ExDebt_{it} - \phi_6 CPI_{it} - \phi_7 PolRisk_{it}) \\ & + \gamma_{i1}^* \Delta \text{Pr } iv_{it-1} + \lambda_{i1}^* \Delta \text{Outgap}_{it} + \lambda_{i2}^* \Delta SOBS_{it} + \lambda_{i3}^* \Delta SOBS_{it}^2 + \lambda_{i4}^* \Delta InDebt_{it} + \lambda_{i5}^* \Delta ExDebt_{it} + \lambda_{i6}^* \Delta CPI_{it} + \lambda_{i7}^* \Delta PolRisk_{it} \\ & + \mu_i + \varepsilon_{it} \end{aligned} \quad (13)$$

In equation (14), if the coefficient  $\lambda_{i2}^*$  is positive and significant while  $\lambda_{i3}^*$  is negative and significant or vice versa, then there is a non-linear relationship between the budget deficit and private investment in the short term.

## 5. Results

To avoid making estimates that have no econometric significance (Granger and Newbold, 1974), preliminary statistical tests of the variables in our analysis were conducted.

### 5.1. Preliminary tests of model variables

In table 2 and 3 below, the unit root test and the Co-integration test are presented.

**Table 2:** Unit Root Panel Tests

Levin, Lin and Chu test (LLC, 2001) Im, Pesaran and Shin test (IPS, 2003)						
<b>Variables in level I(0)</b>						
Variables	Lag(s)	Without trend	With trend	Lag(s)	Without trend	With trend
<i>OutGap</i>	1	0.0002***	0.0004***	1	0.0000***	0.0000***
	2	0.0042***	0.0000***	2	0.0056***	0.0002***
<i>ExDebt</i>	1	0.6187	0.4338	1	0.7001	0.8354
	2	0.5857	0.5910	2	0.2124	0.4638
<i>InDebt</i>	1	0.0000***	0.0000***	1	0.0001***	0.0022***
	2	0.0000***	0.0000***	2	0.0001***	0.0044***
<i>CPI</i>	1	0.9908	0.1619	1	0.8999	0.0517*
	2	0.9812	0.9566	2	0.9458	0.6877
<i>SOBS</i>	1	0.3613	0.9558	1	0.3014	0.6688
	2	0.6045	0.9895	2	0.4746	0.9661
<i>PolRisk</i>	1	0.9900	0.9710	1	0.9609	0.9906
	2	0.9987	0.9888	2	0.9682	0.9999
<i>Priv</i>	1	0.0850*	0.4103	1	0.2235	0.4843
	2	0.1059	0.5385	2	0.1189	0.6435
<b>Variables in first difference I(1)</b>						
	Lags)	Without trend	With trend	Lag(s)	Without trend	With trend
<i>D(GAPPIB); D(ExDebt); D(InDebt); D(CPI); D(SOBS); D(PolRisk); D(PrivIn)</i>	1	0.0000***	0.0000***	1	0.0000***	0.0000***
	2	0.0000***	0.0000***	2	0.0000***	0.0000***

Note: In this table, the values shown represent p-values. \*,\*\*\* represent the significances at 10% and 1% respectively.

**Source:** Authors calculations from "Eviews 9".

**Table 3:** Pedroni and Kao cointegration test of the link between the budget deficit and private investment in CEMAC

Variables	Priv, OutGap, SOBS, CPI, InDebt, ExDebt, PolRisk	Capital gains		
Pedroni test	Within dimension	v-statistic panel	Statistics (S)	0.7464
			Weighted S.	0.8555
		rho-statistic panel	Statistics (S)	0.0151
			Weighted S.	0.0782
		PP-statistic panel	Statistics (S)	0.9037

		Weighted S.	0.9072
		ADF-statistic panel	Statistics (S)
			0.0572
			Weighted S.
			0.0791
	Between dimension	Group rho-statistic	
		0.9801	
		Group PP-statistic	
		0.0309	
		Group ADF-statistic	
		0.0357	
Kao test		ADF-statistic	0.0000
P-value of IPS and LLC test at the level of the residual term			0.0000

**Source:** Authors calculations from "Eviews 9".

The test proposed by Kao et al. (2000) is a null hypothesis test of the absence of Dickey-Fuller and Augmented Dickey-Fuller Co-integration, but assumes homogeneous Co-integration vectors between individuals. Pedroni (2004) proposes seven tests, namely: four statistics based on the *within* dimension (Panel V, Panel rho, Panel PP, Panel ADF) and three statistics based on the *between* dimension (Group rho, Group PP, Group ADF). These statistics are more general because they allow for heterogeneity between individuals under the alternative hypothesis. Thus, under the alternative hypothesis, there is a Co-integration relation for each individual with parameters that may differ from one individual to another. Considering heterogeneity is an undeniable advantage since, in practice, it is rare for the cointegration vectors to be identical from one individual to another in the panel (Hurlin and Mignon, 2007).

## 5.2. Analysis of the causality between the budget deficit and private investment

Indeed, the causality between the deficit of budget balance and private investment requires that the endogenous and exogenous variable of each model be swapped to test the inverse relationship. This means, for example, that for equations (14) and (15) below, an increase in the deficit of budget balance can cause private investment to be crowded out. Conversely, a high level of private investment may limit the efforts of public authorities to try to increase the deficit of budget balance. Relying on the approaches of Odhiambo et al. (2013) and Akapan et al. (2012), we adopt the vector error correction model (VECM) to test the causal relationship between the structural budget deficit and private investment. Contrary to the conventional approach to causality in the Granger sense, this method, besides incorporating the error-correction term (*ECT*), indicates whether there is cointegration. It also allows simultaneous testing of short- and long-term causality. Having undertaken this analysis at the country level, the VECM formulation for equations (14) and (15) is as follows:

$$\Delta Pr iv_t = \delta_0 + \sum_{i=1}^a \delta_{1i} \Delta Pr iv_{t-i} + \sum_{i=1}^b \delta_{2i} \Delta SOBS_{t-i} + \rho ECT_{t-1} + \tau_t \quad (14)$$

$$\Delta SOBS_t = \lambda_0 + \sum_{i=1}^a \lambda_{1i} \Delta SOBS_{t-i} + \sum_{i=1}^b \lambda_{2i} \Delta Pr iv_{t-i} + \varphi ECT_{t-1} + \kappa_t \quad (15)$$

Where ECT is the error-correction term, all variables remain unchanged. Long-term causality is based on the significance of the coefficient of the error-corrected term (ECT). In this case, the direction of causality can only be determined by the F-statistic and the coefficient of the error-corrected term. If this coefficient is negative and significant, the cointegration hypothesis is accepted. The student t-statistic of the explanatory variable allows us to analyze the causal effect on the dependent variable in the short term (Odhiambo et al., 2013; Narayan and Smyth, 2006). There is a two-way causality between the budget deficit and private investment if the coefficients  $\delta_{2i}$  and  $\lambda_{2i}$  of equations (14) and (15) are

statistically significant. If only one ( $\delta_{2i}$  or  $\lambda_{2i}$ ) is, it will be unidirectional causality. Tables 4 to 8 below present the short- and long-term causality between private investment and the structural budget balance in each country.

**Table 4:** Short-term Granger causality test using the VECM (Cameroon-Congo)

Dependent variable		Independent variables or source of causality				ECT (-1)
		Cameroon		Congo		
		$\Delta(Priv)$	$\Delta(SOBS)$	$\Delta(Priv)$	$\Delta(SOBS)$	
Cameroon	$\Delta(Priv)$	-	0,0480 (0,8508)	-	-	-0,1048 (-1,2621)
	$\Delta(SOBS)$	-0,1902 (-1,0430)	-	-	-	-0,0510 (-0,3932)
Congo	$\Delta(Priv)$	-	-	-	-0,0145 (-0,1113)	-0,3699** (-2,6065)
	$\Delta(SOBS)$	-	-	0,0537 (0,2783)	-	-0,1062 (-1,0147)

Note: \*, \*\*, \*\*\* represent significance at 10%, 5% and 1% respectively.

Source: Author from "Eviews 9".

**Table 5:** Short-term Granger causality test from the VECM (Gabon-Equatorial Guinea)

Dependent variable		Independent variables or sources of causality				ECT (-1)
		Gabon		Equatorial Guinea		
		$\Delta(Priv)$	$\Delta(SOBS)$	$\Delta(Priv)$	$\Delta(SOBS)$	
Gabon	$\Delta(Priv)$	-	-0,2706** (-2,3949)	-	-	-0,7927*** (-3,9569)
	$\Delta(SOBS)$	-0,3518 (0,2783)	-	-	-	-0,3221** (-2,4045)
Equatorial Guinea	$\Delta(Priv)$	-	-	-	0,7422* (1,8013)	-0,3840*** (-3,1382)
	$\Delta(SOBS)$	-	-	0,1028** (2,3669)	-	-0,0775 (-1,0448)

Note: \*, \*\*, \*\*\* represent significance at 10%, 5% and 1% respectively.

Source: Authors from "Eviews 9".

**Table 6:** Short-term Granger causality test from the VECM (CAR-Chad)

Dependent variable		Independent variables or sources of causality				ECT (-1)
		RCA		Chad		
		$\Delta(Priv)$	$\Delta(SOBS)$	$\Delta(Priv)$	$\Delta(SOBS)$	
RCA	$\Delta(Priv)$	-	0,0796 (1,0465)	-	-	-0,2734* (-1,8553)
	$\Delta(SOBS)$	0,1630 (0,5547)	-	-	-	-0,3665** (-2,4327)
Chad	$\Delta(Priv)$	-	-	-	0,02698 (0,0880)	-0,1664 (-0,9875)
	$\Delta(SOBS)$	-	-	0,00696 (0,0999)	-	-0,6364*** (-5,5821)

Note: \*, \*\*, \*\*\* represent significance at 10%, 5% and 1% respectively.

Source: Authors from "Eviews 9".

**Table 7:** Long-term Granger causality test using the VECM (Gabon-CAR)

Dependent variable	Independent variable or source of causality			
	Gabon		RCA	
	<i>Priv</i>	<i>SOBS</i>	<i>Priv</i>	<i>SOBS</i>
Gabon	<i>Priv</i>	-	-0,3413*** (-2,8559)	-
	<i>SOBS</i>	-1,0924* (-2,0021)	-	-
CAR	<i>Priv</i>	-	-	0,2911 (1,3388)
	<i>SOBS</i>	-	-	0,7355 (1,1230)

Note: \*, \*\*, \*\*\* represent significance at 10%, 5% and 1% respectively.

Source: Authors from "Eviews 9".

**Table 8:** Long-term Granger causality test from the *VECM* (Congo-Equatorial Guinea-Chad)

Dependent variable	Independent variables or source of causality		
	Congo	Equatorial Guinea	Chad
	<i>SOBS</i>	<i>SOBS</i>	<i>Priv</i>
Congo	<i>Priv</i>	-0,3419* (-1,8741)	-
Equatorial Guinea	<i>Priv</i>	-	-0,8836 (-1,6339)
Chad	<i>SOBS</i>	-	0,5395*** (7,2489)

Note: \*, \*\*, \*\*\* represent significance at 10%, 5% and 1% respectively.

Source: Authors from "Eviews 9".

From Tables 4 to 6 above, it can be deduced that there is no short-term causality between the budget deficit and private investment in four CEMAC countries, namely Cameroon, Congo, CAR, and Chad. On the other hand, there is a negative and unidirectional causal relationship ranging from the budget deficit to private investment in Gabon. Also, Equatorial Guinea is the only country in which there is a two-way positive causality between the budget deficit and private investment. These results are justified in Gabon and Equatorial Guinea because, since 2012, there has been a strong increase in public spending on infrastructure. This is reflected in the World Bank's Logistics Performance Index (2015) and the IMF's Public Investment *Management Index (PIMI)*.

It should also be noted that all CEMAC countries except Cameroon have the coefficient of the error correction term *ECT (-I)* negative and significant in at least one of the directions of the causal relationship, which is evidence of the existence of a long-term relationship between the budget deficit and private investment. To this end, we deduce from Tables 7 and 8 the following conclusions: there is a negative, two-way relationship between the budget deficit and private investment in Gabon. This negative causality also exists in Congo but is generated by the budget deficit to private investment in Congo. The opposite is the case in Equatorial Guinea because the spillover effect is rather positive and emanates from private investment. In CAR, no causality has been detected.

### 5.3. Basic result of the linear model

First of all, verifying the instantaneous impact of the budget deficit and the five other macroeconomic variables on private investment in the CEMAC zone in the short and long term. Next, we test the non-linear effects of the deficit budget balance (with a high-squared term), the interaction effects between the budget deficit and the output gap, and then, between

the budget deficit and public debt (domestic and external). Finally, we examine the simultaneous and interaction effects with the public debt of the components of the budget balance (public investment, public consumption, and public revenue) to assess which one(s) is (are) responsible for the variation in private investment in the CEMAC zone. A prerequisite for this estimation was the detection tests and determination of the number of lags to be retained for the model generated as shown in Table 9 below:

**Table 9:** Determining the Optimal Number of Delays

Information	specification of optimal ARDL model (p, q1, q2, q3, q4, q5, q6)					
Criteria of Pesaran and Shin (1999)						
ARDL (3, 2,..., 2)	ARDL (2,..., 2)	ARDL (2, 1,..., 1)	ARDL (1,..., 1)	ARDL (3, 1,..., 1)	ARDL (1, 2,..., 2)	ARDL (3, 1,..., 1)
AIC	5.835357*	5.856329	5.874895	5.886712	5.892042	5.940239
BIC	6.420640*	7.529313	6.871339	6.783512	6.988131	7.434906
HQ	6.101653*	6.521014	6.278222	6.249707	6.335703	6.545230

Note: \* indicates the lowest value of the selected criteria.

Source: Authors calculations from "Eviews9".

### 5.3.1. Estimate using the structural budget balance as a measure of the deficit of budget balance

Table 10 below summarizes our various estimates. Indeed, our main estimate is in column (1) of Table 10. This shows that the deficit of budget balance taken in isolation does not have a significant impact on private investment in the short and long term. However, its interaction with domestic public debt has a negative and significant effect on private investment at the 1% threshold (column 4). In fact, an increase of one unit of deficit leads in the same direction and significantly in the long term to a 0.69% unit decrease in private investment. Thus, the burden of domestic debt reduces internal savings and causes an increase in interest rates that discourages private agents from investing. This result is like those reached by Khan and Gill (2009), Isa (2012), Frédrick and Okeke (2013), Biza et al. (2013).

Also, the coefficient of the political risk variable is positive and significant at the 5% threshold in the long term. This being the case, an improvement of this index by one unit leads to an increase in private investment of 2.66 units. In fact, in an unstable socio-economic and macroeconomic environment, the public authorities in the zone are increasing their deficit to support the war efforts to maintain peace.

**Table 10:** PMG estimate of the effect of the budget deficit and private investment

Variables	1	2	3	4	5	6	7
<i>Long-run equilibrium</i>							
<i>OutGAP</i>	0,4365** (2,2308)	0,7051* (1,8891)	0,4134* (1,9094)	0,2658** (2,3602)	0,3366* (1,6942)	0,3035* (1,7094)	0,2130** (2,3869)
<i>ExDebt</i>	-0,0169 (-1,2952)	-0,0618 (-1,4941)	-0,0226 (-1,2066)	-0,0074 (-0,5327)	-0,0195 (-1,0024)	-0,1698*** (-4,0399)	0,0062 (0,4490)
<i>IntDebt</i>	-0,0244 (-1,3683)	-0,0672 (-1,3254)	0,0682*** (2,9741)	-0,0092 (-0,3149)	0,0744*** (3,7889)	0,01674 (0,7387)	-0,0949*** (-3,0881)
<i>CPI</i>	0,0646** (1,7899)	0,1406*** (3,8046)	0,0782* (1,7605)	0,0868*** (2,6982)	0,0967*** (2,6401)	0,0354 (0,8378)	0,0969*** (3,3324)
<i>PolRisk</i>	2,6595** (2,2704)	1,7178 (1,0323)	4,2237** (2,1322)	1,9817 (1,4134)	3,6008** (2,0156)	2,6525 (1,3041)	1,9099 (1,5149)
<i>SOBS</i>	-0,0350 (0,3201)	-0,7518 (-0,9389)	-0,4484** (-2,5024)	-0,6912** (-2,0872)	0,5689*** (5,8812)	-0,6151*** (-6,0264)	-0,2901*** (-3,9455)

<i>SOBS*OutGap</i>	0,01896 (0,4427)						
<i>SOBS*ExDebt</i>	-0,0271 (-0,3020)						
<i>SOBS*IntDebt</i>	-0,0169*** (-3,0460)						
<i>SOBS^2</i>	-0,0188** (-2,5257)						
<i>ExDebt^2</i>	0,0165*** (2,8759)						
<i>IntDebt^2</i>	0,0174*** (6,0665)						
<i>Short-run dynamic</i>							
<i>ECT</i>	-0,3114*** (-2,7576)	-0,3468** (-2,1045)	-0,3467** (-2,5440)	-0,3813*** (-3,4171)	-0,3724** (-2,3903)	-0,3683** (-2,2871)	-0,3756*** (-4,0927)
<i>D(OutGap)</i>	3,2709* (2,1996)	-3,9701** (-2,8496)	1,5938** (2,3513)	1,7371* (2,4064)	1,3948** (2,5450)	0,3497* (2,4408)	2,3877* (2,2998)
<i>D(ExDebt)</i>	-0,0133 (-0,4839)	-0,0221 (-0,5068)	-0,0793 (-0,7837)	-0,0281 (-1,1297)	-0,0175 (-0,5388)	0,1694 (1,0974)	-0,0445* (-1,9854)
<i>D(IntDebt)</i>	-0,00015 (-2,0024)	-0,0635 (-0,9864)	-0,0593 (-0,9911)	0,0035 (0,0586)	-0,0616 (-0,9840)	-0,0442 (-0,7323)	-0,2020 (-0,0401)
<i>D(CPI)</i>	-0,3703** (-2,5031)	0,0952 (1,0223)	0,1428** (2,6512)	0,0857** (2,4482)	0,0798** (2,4907)	0,1363** (2,6181)	0,0161** (2,3592)
<i>D(PolRisk)</i>	1,7429** (2,7073)	-0,3703* (-2,0965)	0,4368* (2,0994)	0,8546* (2,2747)	-0,2310* (-2,0586)	-0,4479* (-2,1328)	2,0518** (2,6539)
<i>D(SOBS)</i>	0,0264 (0,2474)	0,3451 (1,5658)	0,1754 (1,3872)	0,0533 (0,4075)	0,2778* (1,7225)	0,2314 (1,6168)	0,1895 (0,9349)
<i>Constant</i>	0,7624 (0,5955)	1,1535 (0,9276)	-2,587*** (-2,7809)	1,0323 (1,1121)	-2,7338** (-2,642)	3,9359* (1,7883)	1,2346 (1,0662)

**Note:** \*, \*\*, \*\*\* represent significance at 10%, 5% and 1% respectively. The values in parentheses are the t-student ratios of the coefficients.

**Source:** Authors estimates from "Eviews 9".

The output gap also has a significant positive effect on private investment. A 1% change in the GDP gap leads to a 0.4365% increase in private investment. This result indicates the counter-cyclical of long-term fiscal policy in CEMAC. This conclusion is contrary to that reached by Talvi and Végh (2005), Alesina and Tabellini (2008), Perotti (2007), Végh and Vuletin (2012), who, in their studies, show that fiscal policy is pro-cyclical in developing countries and acyclical or counter-cyclical in developed countries.

When squared, by testing non-linearity (equation 13), the SOBS, InDebt, and ExDebt variables have significant coefficients (columns 5, 6, and 7). We can therefore deduce the existence of a non-linear relationship between the budget deficit and private investment. We can deduce an inverted U-shaped evolution between the budget deficit and private investment. This conclusion is in line with the logic of Peacock and Wiseman (1967), who demonstrate that the share of public expenditure in GDP does not increase linearly because of economic crises and wars.

### 5.3.2. Robustness checks: an alternative measure of the deficit of budget balance

We also check for the robustness of our results by considering the alternative measure of the budget deficit. We use the global budget deficit sector as a new variable of the budget deficit. Table 11 reports the results based on these alternative measures of the budget deficit.

Again, these results confirm the finding of a significant negative effect of budget deficit interacting with domestic Debt on private investment in the long-run. The results are summarized in Table 11 below:

**Table 11:** Estimated Effects of the Global Fiscal deficit on Private Investment

Variables	8	9	10	11
Dependent variable: Global budget balance				
Long-run equilibrium				
<i>OutGap</i>	0,4172** (2,4098)	-0,5765 (-1,1711)	0,2879 (1,4502)	0,2570* (1,6814)
<i>ExDebt</i>	-0,0722 (-1,2665)	0,0314 (1,3497)	0,0911** (2,3605)	-0,0292 (-1,2158)
<i>InDebt</i>	-0,0051 (-0,1453)	0,0778*** (2,9169)	0,0802*** (3,2794)	0,2467*** (5,5147)
<i>CPI</i>	0,1806** (2,1679)	-0,0272 (-0,6003)	-0,0267 (-0,6427)	(-1,6785)
<i>PolRisk</i>	7,5511*** (5,3336)	8,5474*** (3,4836)	6,8319*** (3,2104)	9,3164*** (4,0974)
<i>SOBG</i>	-0,1413 (-1,4306)			
<i>SOBG*OutGap</i>		0,1146** (2,1217)		
<i>SOBG*ExDebt</i>			-0,0116 (-1,2655)	
<i>SOBG*InDebt</i>				-0,0241*** (-3,7360)
<i>ECT</i>	-0,3081*** (-3,8541)	-0,3339*** (-3,0426)	-0,3096*** (-2,6662)	-0,3230** (-2,2907)
<i>D(GapPIB)</i>	1,4798** (2,9667)	2,7923** (2,5504)	2,5293* (2,1046)	2,1435* (2,1306)
<i>D(ExDebt)</i>	-0,0409 (-1,1228)	-0,0079 (-0,2679)	-0,1276 (-1,0552)	-0,0073 (-0,3443)
<i>D(InDebt)</i>	0,0027 (0,0507)	-0,0477 (-1,1208)	-0,0492 (-0,9328)	-0,0512 (-0,6119)
<i>D(CPI)</i>	-0,1240** (-2,7547)	0,0728 (0,9364)	-0,0044* (-2,0489)	-0,0540** (-2,4944)
<i>D(PolRisk)</i>	-2,1057** (-2,5769)	-1,5167** (-2,8671)	0,5669* (2,1691)	0,0377* (2,0082)
<i>D(SOBG)</i>	0,0731 (0,3807)			
<i>Constant</i>	-1,4506* (-2,1032)	-2,3049* (-2,4674)	-2,5823** (-2,1827)	-2,2897* (-1,7091)

**Note:** \*, \*\*, \*\*\* represent significance at 10%, 5% and 1% respectively. The values in parentheses are the *t*-student ratios of the coefficients.

**Source:** Authors estimates from "Eviews9".

It follows from Table 11 that the estimates obtained are convergent and confirm the previous analyses.

#### 5.4. Analysis of non-linear model estimation

This estimate is made on a country-by-country basis because, although CEMAC countries have adopted convergence criteria that include budgetary constraints, it must be noted that fiscal policies are still strongly influenced by national concerns and are not

harmonized. Table 12 below presents the results of the identification of budget deficit thresholds at the level of each CEMAC country.

**Table 12:** Estimation Results of the Regime Shift Model Estimates

Variables	Cameroon	Chad	Congo	Gabon	Eq Guinea	CAR
<b>Regim 1</b>	<b>SOBS&lt;-1,905</b>	<b>SOBS&lt;-12,15</b>	<b>SOBS&lt;-3,013</b>	<b>SOBS&lt;-5,46</b>	<b>SOBS&lt;-8,62</b>	<b>SOBS&lt;-0,397</b>
SOBS	0,0708** (2,5539)	1,8974*** (3,9850)	0,7504*** (3,5982)	2,7393*** (2,8753)	0,7228*** (2,8358)	0,1167** (1,9768)
InDebt	0,0231** (2,4911)	0,2777** (2,3797)	0,0152** (2,2049)	0,1436** (2,5292)	0,1629** (2,7881)	0,0072** (2,5354)
ExDebt	0,01477** (2,3563)	0,7483** (2,5561)	0,0351* (1,8746)	0,03004** (2,2964)	0,0699** (2,2706)	0,0535** (2,2703)
<b>Regim 2</b>	<b>SOBS≥-1,905</b>	<b>SOBS≥-12,15</b>	<b>SOBS≥-3,013</b>	<b>SOBS≥-5,46</b>	<b>SOBS≥-8,62</b>	<b>SOBS≥-0,397</b>
SOBS	-0,6809** (-2,2294)	-0,8503*** (-2,9739)	-0,09944** (2,3998)	-1,2114*** (-4,2021)	-0,0662** (-2,1559)	-0,2047** (-2,5057)
InDebt	-0,2305** (-2,6116)	-0,8277*** (-3,8676)	-0,1030** (-2,5248)	-0,0444** (-2,2829)	-0,3231** (-2,6632)	-0,1255*** (-3,9076)
ExDebt	-0,0298** (-2,3930)	-0,2366** (-2,3061)	-0,0583* (-1,9657)	-0,2434*** (-3,2165)	-0,4707*** (-3,3755)	-0,0653** (-2,4074)
OutGap	0,04208 (0,6349)	-0,0431 (-0,4902)	-0,0067 (-0,0678)	-1,2896 (-0,8113)	1,9515 (1,3189)	1,9073*** (3,4750)
PolRisk	3,0167*** (19,8152)	2,7134*** (5,1209)	1,6097*** (5,5017)	3,2194*** (30)	2,6436*** (3,2918)	-2,3744*** (-10,7475)
CPI	-0,0505 (-1,1366)	-0,5532*** (-3,3754)	0,5397*** (3,0755)	-0,0978 (-0,9728)	-0,9161 (-1,1182)	0,0386 (1,0847)
R <sup>2</sup>	0,7781	0,6597	0,7974	0,5716	0,7357	0,8244
$\bar{R}^2$	0,7124	0,5589	0,7636	0,5457	0,6574	0,7724

*Note:* \*,\*\*, \*\*\* represent the significances at 10%, 5% and 1% respectively. The values in parentheses are the t-student ratios of the coefficients.

*Source:* Authors calculations from "Eviews9".

In Table 12 above, the results of the estimates provided relate to the threshold model with the budget deficit as the transition variable. It follows that in each of the CEMAC countries, there are at least two different regimes for the impact of the fiscal deficit on private investment. Having noted a disparity in the thresholds at the country level, we, therefore, found it inconsistent to estimate a common threshold for all CEMAC countries. Concerning the different thresholds obtained per country, it can be noted that the fiscal balance effect regimes can be grouped according to the fiscal deficit effort required to stimulate private investment.

In the first regime, all CEMAC countries with low levels of budget deficits necessary stimulate private investment.

Indeed, in Cameroon, Congo, Chad, Gabon, Equatorial Guinea, CAR, for a threshold below -1,905%, -3,013%, -12,15%, -5,46%, -8,62% and -0,397% of GDP respectively, the budget deficit can contribute to an improvement in private investment. Under this regime, the budget deficit has a positive and significant effect, as does public debt (domestic and external). Since the two debt variables are significant, this implies that they constitute constraints on increasing the budget deficit up to this threshold.

In the second regime, for a threshold greater than or equal to those above threshold in all CEMAC countries, the budget deficit is harmful to private sector activity. Its size could be reduced by the government's recourse to domestic savings (launching of the bond issue) since the domestic public debt ratio is positive and significant at the 5% threshold. Moreover, the socioeconomic environment allows for this (the political risk) variable contributes positively and significantly to private investment in all CEMAC countries. The government could not

also apply for a loan from bilateral and multilateral donors (IMF, World Bank) due to the significant negative sign of the external public debt ratio.

Consequently, the Chadian government should make efforts to keep the deficit threshold below -12.15% of GDP. However, in Gabon, however, there is an intermediate threshold ( $-5,464,238 \leq \text{SOBGGAB} < -0.1568499$ ). Within this range, the budget deficit has a negative and significant impact on private investment. At this threshold, both public debts contribute to private investment.

## 6. Conclusion and policy implication

The primary objective of this study was to assess the impact of the deficit of budget balance and public debt on private investment in the CEMAC. The *Pooled Mean Grouped (PMG)* estimate showed that the budget deficit has no significant impact on private investment in either the short or long term. This findings are opposite to the work of Vincent and Clem (2013) which find the negative growing out of public deficit on private investment in the long-run. However, its interaction with public debt (domestic and external) significantly deteriorates private investment in the long-run. Subsequently, squaring the fiscal deficit and public debt (domestic and external) variables allowed us to detect the non-linear relationship between the fiscal deficit, public debt, and private investment, which led us to estimate a regime-switching model at the level of each country. The estimation results indicate one fiscal regimes for improving private investment at the level of each CEMAC country, except Gabon, where an intermediate threshold was detected. For each country, there is a threshold for which the budget deficit and public debt significantly reduce private investment. This result goes in the same direction with that of Tank (2014) which find the U-sharped relationship between budget deficit and private investment. It would be important for CEMAC countries to monitor their level of fiscal sustainability, and their level of debt (domestic and external). One of the major difficulties associated with this study stems from the lack of data over a long period for all countries in the subregion that would enable us to obtain more relevant results. We were also limited in this study by the absence of data on certain variables in most CEMAC countries, such as taxation, which plays a crucial role in promoting entrepreneurship (Andrews and Campos, 2003).

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## Appendix

**Table 1:** Summary of variables and their signs

Endogenous variable	IPRI	The ratio of private investment to GDP
Exogenous variables	Sign	Measure
GapPIB	+/-	The gap of GDP or the output gap
IPC	+/-	Consumer Price Index in % per annum
SOBS	+/-	The ratio of structural budget balance to GDP
IPTD	+/-	The ratio of domestic public debt to GDP
DTPEX	+/-	The ratio of external public debt to GDP
PR	+/-	The quality of institutions
IPU	+/-	Public Capital Expenditures
DCP	+/-	Foreign Direct Investment

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RECP - Gross Domestic Credit

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Source: Authors from the literature review