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# The Impact of Budgetary Policy on Economic Growth in Mali (The search of Non-linear Effect)

DOUMBIA Issouf
Ph.D. student
Dongbei University of Finance and Economics (DUFE)

WEIGUO Wang
Ph.D. professor
Dongbei University of Finance and Economics (DUFE)

**Abstract**
Several studies have been conducted in recent years on the effectiveness of budgetary policy on economic growth. Many authors argue that a government's taxation and expenditure policies can change or even affect all economy. By cons, others argue that the economy is still in an overall equilibrium situation and subsequently budgetary policy would be ineffective or even detrimental to economic growth. This study aims to analyse empirically the impact of budgetary policy on economic growth in Mali. Particularly the search of nonlinear effect. Based on institutional benchmarks, a possible non-linear relationship appears. We have through the implementation of robust methods, found optimal thresholds of the deficit to 1% of the GDP and its external and internal financings respectively has 2.6% and -1.6% of the GDP. The study tries to assess the impact of budgetary policy on growth taking account of external public indebtedness stocks level. With an external debt threshold below 67% of GDP it appears that budgetary policy is Keynesian.
**Keywords:** Budgetary Policy, Deficit, Financings, Growth, Threshold Effects, Debt

## 1. Introduction

The economic and financial crisis beginning in 1992 affected Mali like other West African Economic Monetary Union (WAEMU) countries. This crisis was manifested by weak economic growth, an increase of fiscal deficits and deteriorating competitiveness indicators. The immediate consequences were the explosion of the debt ratio and the inability of Mali to cope with debt service obligations and consequently the institutions, the IMF and WAEMU have imposed austerity measures capping budget deficits and public debt at sustainable levels. Recent thinking on the assessment of the relative impact of the intervention of main donors is that the debt has remained unsuitable Sarr, (2005). For this purpose, we must specify that the recent relief and cancellation of Mali's external debt are sufficiently exogenous and abrupt for not having been linked to a particular financial situation. However, if the adjustment implemented by the government of Mali with the support of the Breton Woods institutions have been somewhat inefficient in slowing debt growth, they have been able to prove that the rationalization of the public finance management can generate productivity earnings and economic growth. This restrictive new approach to the budgetary policy takes the opposite effect of the Keynesian multiplier, whereby the expansionist approach to the budgetary policy generate growth since it boosts domestic demand.

From 1992 to the present day, two contradictory policies have been conducted by the State of Mali alternately and not regularly, thus creating ambiguous effects on economic activity. The State difficulties are caused by this ambivalence between contra-cyclic activity by which it seeks to boost economic activity through a budgetary policy, and the respect of major equilibrium synonymous with budget contraction. From this ambivalence, we can assume the possibility of a non-linear relationship between economic growth and budgetary policy.

This study seeks to assess the influence of budgetary policy on the pace of economic activity in Mali. These reflections are part of a very current context where the public financial management is subject to major controversies while monetary policy remains confined to inflation control objectives. The search for non-linear effects is the main focus of this work, this should help to draw the inherent teachings in the weakness and strengths of the policy to be expansionary or restrictive. This study differs from other studies in this area, which generally assume a linear relationship between budgetary policy and economic growth. A particular attention of the economic literature has been given to the analysis of the impact of different budgetary variables on the growth of the activity. Taking into account the budget constraints of the State, economic theory states that any change in magnitude of a budgetary variable systematically leads to a compensating change in one or more other budgetary variables. It must be admitted that this principle is often omitted in empirical studies which, often analyze the effect of changes in a budget category (for example, public consumption expenditure) while implicitly assuming that the compensatory changes that they cause do not effect to the activity. It would be possible to overcome this weakness in this study by using appropriate econometric methods.

The second section reviews the economic and financial characteristics of Mali. In this section, we will try to

describe the effects of the budgetary policy on economic activity has given the various economic programs implemented by the successive government since 1992. The analysis proves that the reaction of growth to budgetary policy is imbued with a certain ambiguity synonymous with the existence of non-linear effects.
The third section relies on the second to erect the theoretical basis of the non-linearity of budgetary policy. The fourth section is the econometric application using the Hassen (2000) methodology which is based on the estimation of the threshold model. The fifth section is devoted to the interpretation of the results. Finally, the last section is reserved for a conclusion.

## 2. Institutional references

The budget area has been subject to a few controls since Mali's accession to independence until the early 1990s. This consisted mainly of limiting the statutory advances of the central bank to the public treasury, advances capped at 20% of tax revenues. These restrictions on resource levies for the monetization of the public deficit were seen as an effective way to fight against the uptake of seigniorage by national authorities. By this control, the budgetary action of the State was based only on its strength to act on the tax rate with a limited capacity in the short term the narrowness of the tax base and the weaknesses of the administration or its ability to access external financing of the deficit. In addition to its ability to resort to external borrowing, the Malian government was able to expand its resources through special levies attributable to the field of stabilization of international prices of products intended for export. Thus, the strong surge in the price of phosphate, cotton and gold intervened at the late 1970s was an opportunity for Mali to significantly increase its public spending. The government mobilizing external funds through commercial banks had amplified the impact of the boom. The result was a considerable increase in State expenses and an increasingly unsustainable public debt[1].

The cyclical revenues induced by the cotton and phosphate prices shocks have maintained a general budgetary excess when wisdom would have advised the State to prudently manage fiscal duties to avoid structural phenomena comparable to Dutch disease and these budget deficits later unbearable (Ary Tanimoune, Combes et plan, 2005). To overcome these macroeconomic imbalances, since 1980, Mali has been engaged in a process of orderly adjustment of its economy. This adjustment policy depended on the implementation of economic and financial programs of the Breton Woods and WAEMU institutions for the periods 1982-1992, 1994-2000, 2002-2010 and 2012-2016 Its main objectives were to restore the overall balance, by reducing the budget deficit, controlling of the inflation rate, promoting and reinvigorate private savings and opting for healthy and sustainable growth.

In what follows, our work will mainly focus on the analysis of the impact of budgetary policy on the pace of economic activity taking into account to the role played by various economic and financial adjustment programs set up by the state since 1992 to the present day.

**Table 1 summarizes the characteristics of the Malian economy while presenting the variables under the budgetary field**.

| *Variables* | *symbol* | *1992-1996* | *1997-2001* | *2002-2006* | *2007-2011* | *2012-2016* |
|---|---|---|---|---|---|---|
| *Economic characteristics* | | | | | | |
| *Annual growth of real GDP* | *GGDP* | *2.6%* | *2.6%* | *3.00%* | *3.2%* | *3.1%* |
| *annual average of rain* | *RAIN* | *0%* | *-2%* | *9%* | *5%* | *0%* |
| *Privet investment in % of GDP* | *P.INV* | *15%* | *10%* | *12%* | *14%* | *10%* |
| *Internal Debt in % of GDP* | *I.DEBT* | *3.18%* | *1.68%* | *2%* | *3.1%* | *3.3%* |
| *Total Debt in % of GDP* | *T.DEBT* | *101%* | *83%* | *53%* | *22%* | *23%* |
| *Budget variables in % of GDP* | | | | | | |
| *Budget revenue* | *B.REV* | *8%* | *13%* | *17%* | *20%* | *28%* |
| *Fiscal revenue* | *F.REV* | *7%* | *11%* | *14%* | *20%* | *23%* |
| *Non-fiscal revenue* | *N.F.REV* | *2%* | *7%* | *3%* | *13%* | *20%* |
| *Grants* | *Grant* | *4%* | *4%* | *11%* | *5%* | *4%* |
| *Current expenditure* | *CU.EXP* | *7%* | *10%* | *13%* | *15%* | *20%* |
| *Capital expenditure* | *CAP.EXP* | *7%* | *9%* | *9%* | *11%* | *11%* |
| *Residuals expenditure* | *RE.EX* | *1%* | *1%* | *1%* | *2%* | *4%* |
| *External financing* | *EXT.FIN* | *4%* | *3%* | *-3%* | *3%* | *2%* |
| *Internal financing* | *INT.FIN* | *-1%* | *0%* | *-2%* | *1%* | *2%* |
| *Budget deficits* | *B.DEF* | *2%* | *3%* | *-5%* | *3%* | *5%* |

The economic power was strongly engaged in the supervision of the rural world in particular through the Malian Company for Textile (CMDT) which is the company supervising the production and marketing of cotton and also through the Office du Niger which Its mission was to supervise the sector.

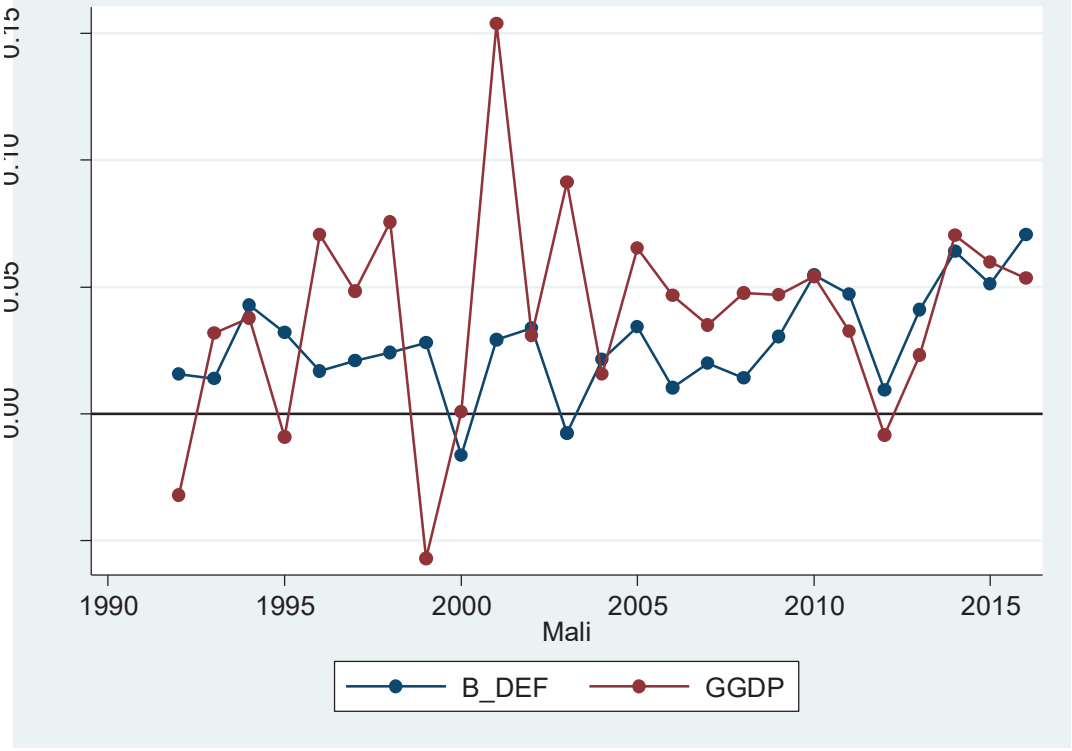
Despite its weak economic situation and face the challenges of the fight against poverty, Mali began under the leadership of WAEMU a series of reforms in key sectors of the economy such as the cotton industry and infrastructure (Energy, Transport and telecommunication). These reforms aim to rationalize the tax

[1] Official Government Report on Adjustment Policies in Mali and Calculations from National Accounts.

administration by fixing the VAT at the single rate of 18%, the introduction of synthetic tax for small businesses, the introduction of the unique tax identification number, the adoption common external tariff, the computerization of the customs administration and a redefinition of the taxation of petroleum and mining products. Since the implementation of the Convergence, Stability, Growth and Solidarity Pact in December 1999, the objective of the budgetary policy is to respect these criteria established by WAEMU for economic integration in 2005. Over three years Mali has met two first-order criteria (a positive basic fiscal balance and the non-accumulation of arrears) and two second-ranking criteria (a payroll of less than 35% of tax revenue and capital expenditure on financing internal excess of 20%). Thus, the budgetary tensions linked to the poverty reduction priorities associated with the weakness of the Malian tax administration do not make it possible to take the respect of the budget balance criterion as acquired.

**Table 1 Variation in growth rate and budget deficit**




*Source: Author*

The issue of indebtedness in Mali was successfully resolved by reaching the completion point in 2004, with as corollary of allocating part of the debt service savings to the basic social sectors in accordance with the objectives of the HIPC initiative[1]. In 2005, under the Multilateral Debt Initiative (MDRI), Mali benefited from the cancellation of most of its multilateral debt, resulting in the stock of its external public debt at 15% of GDP. This low level of indebtedness would have given the State more leeway in view of the easing of the budgetary constraint observed in 2007. In 2015 French Department of finance announced 65 million Euros cancellation of Mali's public debt. French held this claim with Mali since 1984, a monetary debt of an initial amount of 229 million euros.

Finally, with regarding the relationship between budgetary policy and economic growth, it must be emphasized that from 1990 until the end of 1999, budgetary restrictions under adjustment programs against all odds, gone hand in hand with a slowdown in growth.

Table 1 shows these downward movements in the deficit relative to GDP and economic growth during this period. In addition, the following last decade marked by a greater budgetary austerity was favorable to economic growth. More explicitly, Figure 1 does appear that from 1992 to 1999, contractions deficit accompanied a growing increasingly weak and often negative. Conversely, in the post-1999 period, the deficit and the pace of activity show contradictory trend trends. It can be summarized that events from 1992 to the end of 1999 seem to be close to the Keynesian logic of fiscal policy while those observed after 1999 seem to be non-Keynesian or anti-Keynesian. Subsequently, the relationship between budgetary policy and economic growth could be non-linear.

[1] HIPC: Heavily Indebted Poor Country

## 3. Literature reviews

### 3.1. Budgetary Policy according to the Keynesian Model

One of the main macroeconomic principles is that the budgetary policy can be used to stimulate aggregate demand and revive a stagnant economy. This Keynesian concept of counter-cyclical activism is taught in introductory books to the economy. The expansionary role of budgetary policy is generally based on the IS-LM model, which clearly shows the multiplier effect of increases in public spending or lower taxes. Two manners of an intervention of the State are opposed to the Keynesian scheme to regulate the economic activity. These go through discretionary measures or by the establishment of automatic stabilizers. In Europe, the European Union commission largely recommends the use of automatic stabilizers since they provide an answer to the forecast errors in an environment dominated by uncertainty which compromises the relevance of the discretionary orientations (Dolls et al., 2012 and Prommier, 2003, among others). Similarly, in the case of the United States, Solow (2002) recommended the return of automatic stabilizers which have gradually weakened since the end of World War II. As the automatic stabilizers have very limited power in developing countries like Mali, the governments are often forced to use discretionary measures and additional obstacles. The main criticism of the Keynesian approach to budgetary policy is that it does not take into account the phenomena of anticipation and inter-temporality in its analysis. Thus, an expansionary budgetary policy does not always make it possible to get an economy out of a recession, especially when the public debt is high and unsustainable. In this case, the expectations of the economic agents that an increase in the deficit leads to a decline in investment and consumption, thus canceling the effect of the increase in expenditure or tax relief.

### 3.2. Classic Concept of the Neutralist of Budgetary Policy

In recent years, several arguments have been put forward into question the use of budgets policies with a view to stabilizing the economy. Classic models inspired by Real Business Cycles (RBC), which postulate that the economy is still in a state of global equilibrium, conclude to the budgetary policy uselessness. Around 1980, macroeconomics was marked by the development of the RBC theory following criticism by Lucas (1987) who discredited the utility of Keynesian-type models for evaluating the effects of economic policy. Kydland and Prescott (1983) are the pioneer of the concept of real-cycle theory. Cooley (1995) and Prescott (1998) provide a more detailed literature review. The theory starts from the description of an economy based on the demands of a single representative immortal consumer that maximizes an additive utility function to standard mathematical properties, under a set of perceived constraints.

This trend is defined as the set of models seeking to establish that the optimal responses of economic agents to shocks of a real nature can produce cyclical characteristics close to those observed. More precisely according to (Ertz,2001), economic cycles would result from the optimal responses of economic agents to shocks that modify the efficiency of the productive combination interpreted essentially as technological. Thus, many economists see these works exclusively provocative aspect of the ineffectiveness of budget policy see Pavlina R. Tcherneva, (2011) and Solow (2002). Indeed, extreme interpretation of this trend is that it does not value the existing stabilization policies. In the same vein, the principle of Ricardian equivalence initiated by Barro (1974) supports the ineffectiveness point of view of budgetary policy.

Barro's proposal is that from a macroeconomic point of view, if economic agents behave rationally, tax cuts financed by public debt (a stimulus policy) do not grow to consume, but rather to save, in anticipation of future tax increases. The neoclassical theory of budgetary policy is criticized on several levels especially if consumers are not very foresighted, they tend to minimize future consequences of the current budgetary choices. Moreover, in a poor country like Mali, there is a real difficulty in implementing an optimal consumption plan because consumers do not have enough income (or liquidity) and cannot borrow freely because of the multiple financial market imperfections.

### 3.3. New Anti-Keynesian Theory of Public Finances (NAKT)

This new theory is an extension of the classic vision that, beyond the inefficiency of the budgetary policy, it pronounces on its recessive nature. According to Ertz (2001), the extreme interpretation of the theory rests on the idea that the measures implemented to mitigate the severity are likely to be more costly than beneficial. The arguments are based essentially on the constructionist experiences of the Northern European countries in the 1980s, which succeeded in boosting economic activity by reducing public spending in a strong, rapid and sustainable way. (Llau, 1999). As Giudice et al (2003) points out, this theory is widely used in both European communities as well as universities. Moreover, adjustment and budget consolidation programs proposed by the IMF is essentially inspired by this new anti-Keynesian vision (Baldaacci et al., 2003). In fact, several studies show that a reduction of the budget deficit can accelerate growth especially when public debt is high and unsustainable Perotti, (1998)[1].

[1] Another explanation for the expansive nature of the fiscal contraction is developed by Alesina and Perotti (1995) and Alesina and Ardagna

A reduction in government borrowing to finance expenditures through a systematic deficit typically pushes interest rates downward, encouraging investment. Lower interest rates also increase the value of assets, and this wealth effect encourages private consumption and investment. In addition, lower deficits are pushing the private sector to reduce estimates of current and future tax liabilities, further boosting investment and consumption[1]. Finally, the reduction of public employment and the anticipated fall in labor taxation lead to lower wages and thus higher corporate profits, which favors investment Alesina et al., (2002).

However, the argument is based on several debatable postulates. Indeed, detractors of the **NAK** theory can play only in a classical situation where production is constrained by supply or when this situation is reached in the near future. In addition, agents anticipate future production according to a neoclassical (and not according to Keynesian) scheme: production depends negatively on taxes by the effect of supply and not positively on public expenditure. This is problematic, especially when it comes to infrastructure investments, research spending (which can increase the productivity of the economy), or some household spending (health, education, retirement). Finally, NAK theory implies that anticipation effects are more important than liquidity effects. For example, a decrease in current taxes, with public spending unchanged, leads to an increase in consumption of constrained households (since they anticipate a future increase in taxes and they know that it will induce a decline in production), the second effect outweighs the first.

### 3.4. Nonlinear Effects of Budgetary policy

The preceding paragraphs have allowed reviewing the theoretical elements that underpin the existence of three effects of the use of fiscal instruments by the government. These assumptions are undoubtedly relevant for the Malian economy which, according to historical facts, has been confronted with economic policy measures with ambiguous effects on its activity. The difficulty could come from the ambivalence between the counter-cyclical activism by which the State seeks to boost economic activity through budgetary policy, and the respect of major balances synonymous with fiscal contraction. Thus, the possibility of a non-linear relationship between economic growth and budgetary policy is not to be ruled out. In theory, all depends on the initial public finances situation, notably the public deficit (Adam and Bevan, 2005) and the level of indebtedness (Bertola and Drazen, 1993, Sutherland, 1997, Ary tanimoune et al., 2005). The first authors have shown that there is a non-linear relationship between the budget deficit and economic growth. Through a sample of 45 developing countries, they estimated that an equivalent deficit of 1.5% of GDP corresponds to a threshold level beyond which the policy is expansionary but becomes recessive in the opposite case.

For the latter, the nonlinearity of budgetary policy may result from a psychological threshold of public debt making an inevitable budgetary adjustment. Faced with a sustainable public debt, the agents assume that debt refund will depend on future generations. In this case, a deficit has Keynesian effects. However, in the presence of a deemed unsustainable debt, the agents expect to bear themselves the weight of refund, so that the effects of deficit become anti-Keynesian. This debt threshold was estimated at 83% by Ary Tanimoune et al. (2005) for the WAEMU countries. Considering two samples of developed and developing countries, Giavazzi et al. (2000) show a significant nonlinear relationship between the budget balance and national savings. By cons, Alesina et al. (2002), the OECD works, statistically reject the hypothesis of a nonlinear relationship between budget shocks and private investment.

The following sections will focus on the quantitative analysis of the non-linear effects of budgetary policy on Mali's economic growth.

## 4. Empirical analysis

In this work, we used the methodology inspired by that of Adam and Bevan (2005). It makes possible to assess and to identify the possible non-linear effect of budgetary policy on economic growth. Beforehand to the presentation of the model, it is instructive to consider the point cloud (in blue) in figure 2, which relates in a form of non-parametric relationship between budget deficit and economic growth.

To determine this nonparametric form, we use the semi-parametric regression method.

$$GGDP = X\beta + F(B.Def) + \epsilon \qquad (1)$$

Where, $GGDP$ is the GDP growth rate, $X$ represents the control variables vector, (private investment to GDP and rainfall),

$B.Def$ represent the budget deficit to GDP,

$\epsilon$ is the error terms vector assumed to be independent and identically distributed,

From the equation (1), $E(GGDP|B.Def) = E(X|B.Def)\beta + F(B.Def)$ with $E(\varepsilon|B.Def) = 0$ .

(1998) who emphasized the composition effects of adjustment and the initial state of public finances.

[1] See Creel et al (2005) for more detailed presentation.

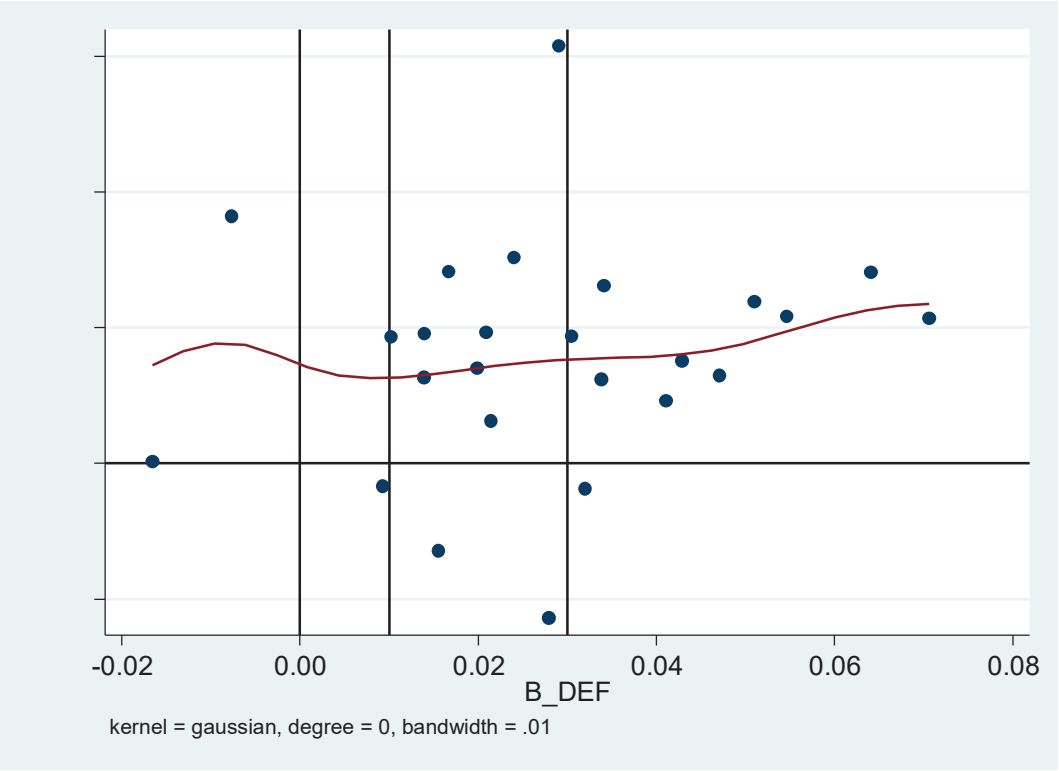
The estimate of $F(B.Def)$ is thus obtained by the following expression: $\hat{F}(B.Def) = \hat{E}(GGDP|B.Def) - \hat{E}(X|B.Def)\hat{\beta}$ the conditionals means $\hat{E}(GGDP|B.Def) and\ \hat{E}(X|B.Def)$ are estimated by the Kernel method.

The asymptotically efficient estimator of $\beta$ is obtained by transforming the initial regression: $GGDP - \hat{E}(GGDP|B.Def) = [X - \hat{E}(X|B.Def)]\beta + \varepsilon$

The continuous line is a nonparametric adjustment achieved by applying smoothing technique by the kernel method with a smoothing parameter (bandwidth 0.01).

To facilitate the reading of the curve we draw vertical lines equivalent to a deficit of 0%, 1% and 3% of the GDP.

**Figure 2: Non-linear relationship between Budget deficit and economic growth.**




This first analysis can give some plausibility to the intuition that there would be a threshold deficit from which the budgetary policy would take a different turn. Thus, the study retains a modelling in terms of a threshold effect.

### 4.1. Threshold Models Specification:

To examine this concept of non-linearity of budgetary policy more thoroughly, this study proceeds in three stages. In first, the impact of the deficit on growth is studied given the budget constraint which stipulates that State resources are equal to expenditures. Thereafter, the deficit is replaced by its external financing. In both cases the threshold effects are tested and estimated. Finally, the study proposes to model the impact of budgetary policy on growth, conditional of the debt stock level.

### 4.2. Threshold Models Apply on the Budget Deficit

The first specification is the following form.

$$GGDP_t = \sum_{i=1}^{n}\beta_i X_{it} + \sum_{j=0}^{m}\omega_j W_{jt} + \theta[W_{1t-}\widetilde{W}_1]D_0 + u_t \qquad (2)$$

Where $D_0 = \begin{cases} 1\ if\ W_{1t} > \widetilde{W}_1 \\ 0\ if\ W_{1t} \leq \widetilde{W}_1 \end{cases}$ and $u_t$ represent error term.

The equation (2) is a time series regression where the variables are indexed by time.

- $\beta_i$ , $\omega_j$ $and$ $\theta$ are the parameters to be estimate.
- $GGDP_t$ is a real GDP growth rate.
- $X_{it}$ allow to control the actions of other relevant variables (Private investment and rainfall).

- $W_j$ are the budgetary variables (budget revenues, grants, current expenditure excluding interest on debt, interest on debt, capital expenditure, residual expenditure and budget deficit) with $W_1$ budget deficit.

The equation (2) suggests that the marginal effect of the budgetary deficit varies around a threshold value of the deficit represented by $\widetilde{W}_1$. Furthermore, the budgetary variables respect at all times the following budget identity: $\sum_{j=0}^{m} \delta_w W_j = 0$ where $\delta_w$ takes 1 and -1 as values depending on whether $W_j$ is an expense or resource, then to avoid a perfect collinearity between the regressors, the estimate of the equation (2) parameters requires the elimination of one budgetary variable.

Let denote by $W_0$ this eliminate fiscal variable, then the equation (2) is rewritten as follow:

$$GGDP_t = \sum_{i=1}^{n} \beta_i X_{it} + \sum_{j=1}^{m} \vartheta_j W_{jt} + \theta[W_{1t} - \widetilde{W}_1]D_0 + u_t \qquad (3)$$

Thus, the $\vartheta_j = (\omega_j - \omega_0)$ coefficient measures the marginal impact of budgetary variable $W_j$ on the growth, the net marginal impact of the excluded variable[1]. Adam and Bevan (2005) point out that most of the empirical study in this area is trapped by the simple assumption that the exclude variable has no effect on growth (growth neutral) and therefore the coefficient $\vartheta_j$ would be the gross marginal effect of the variable $W_j$ on growth, based on the remark of Kneller and al. (2000). Such an assumption can not be supported since it is not possible to measure directly from the data the gross of a budgetary variable i.e. or to carry out empirical tests proving the neutrality of a given variable some budget category.

Some authors state that there is a need to thoroughly disaggregate the accounts in order to collect certain categories of expenditures or resources with similar net effect on growth. In this way it is possible to calculate the gross effect $\omega_j$.

Since it would be difficult to achieve such a disaggregation level without compromising the quality of the data, we propose a distribution which will then allow to choose the exclude variable.

As for state resources, the variables are fiscal revenues, grants and budget deficit.

As for state expenditures, the variables are current expenditures excluding interest on debt, interest on debt, capital expenditures and residual expenditures.

Table 1 provides detailed information on these variables.

### 4.3. Threshold Models with inclusion of Deficit funding

Obviously, the budget deficit effect cannot be properly captured independently of its internal and external funding. In the second model the deficit is replaced by its funding sources as follows:

$$GGDP_t = \sum_{i=1}^{n} \beta_i X_{it} + \sum_{j=2}^{m} \vartheta_j W_{jt} + \theta_1 V_{1t} + \theta_2 V_{2t} + \theta_3[V_{1t} - \tilde{V}_1]D_1 + \theta_4[V_{2t} - \tilde{V}_2]D_2 + u_t \qquad (4)$$

Where $V_1$ and $V_2$ represent the external and internal funding with as threshold values $\tilde{V}_1$ and $\tilde{V}_2$ respectively. $D_1$ and $D_2$ are Dummy variables and had the same property as $D_0$ in equation (2).

### 4.4. Threshold model's conditional to debt

The following equation modelled the budgetary policy effects on growth conditional on the stock of external public debt:

$$GGDP_t = \sum_{i=1}^{n} \beta_i X_{it} + \sum_{j=2}^{m} \vartheta_j W_{jt} + \pi_1 W_{1t}^{inf}(\hat{\gamma}) + \pi_2 W_{jt}^{sup}(\hat{\gamma}) + u_t \qquad (5)$$

$$W_{1t}^{inf}(\hat{\gamma}) = \begin{cases} w_{1t} & if\ Ext-Debt \leq \hat{\gamma} \\ 0 & if\ Ext-Debt > \hat{\gamma} \end{cases} \text{ and } W_{1t}^{sup}(\hat{\gamma}) = \begin{cases} w_{1t} & if\ Ext-Debt > \hat{\gamma} \\ 0 & if\ Ext-Debt \leq \hat{\gamma} \end{cases}$$

The Ext-Debt variable represents the stock of the external debt reported to the nominal GDP (see Table1). A (normal) regime is characterized by a level of debt less than or equal to the threshold $\hat{\gamma}$, otherwise it is called a (critical) regime.

The marginal effect $\pi_1$ and $\pi_2$ should be different under the budgetary policy regime. It is expected that the relationship between budget deficit and economic growth is positive in normal regime (Keynesian effect, $\pi_1 > 0$). In critical regime the theories predict a zero effect of budget deficit (non-Keynesian effect, $\pi_2 = 0$) or a negative effect (anti-Keynesian effect, $\pi_2 < 0$).

[1] If the exclude variable is an expense, $\vartheta_j$ measures the marginal impact of a decrease in the excluded expenditure to finance an additional increase in expenditures. On the other hand, if the exclude variable is a revenue, this parameter measures the net effect of an increase in an expenditure financed by an increase in the exclude revenue.

### 4.5. Threshold effect test

We use the methodology developed by Hansen (2000) to test a threshold existence in the impact on the growth of the budget deficit and its financing. It is a scanning method in which the reference equation is estimated for different threshold value.

Let denote $S(\widetilde{W}_1) = \hat{u}(\widetilde{W}_1)'\hat{u}(\widetilde{W}_1)$ as the residuals sum squares of the model defined by the equation (3) estimated with a threshold level equal to $\widetilde{W}_1$.

The optimal threshold level is then: $\breve{W} = \underset{\widetilde{W}_1}{\text{Argmin}} S(\widetilde{W}_1)$ (6)

The optimal threshold $\breve{W}_1$ is determined from the equation (3) estimated for all possible values of the deficit between -2% and GDP, separated from each other by half a point of interval. The same procedure is used to identify optimal threshold of the budget deficit financing. Hansen test also determines the threshold of the debt stock although its interpretation is different from those of the deficit and its funding sources.

Indeed, the threshold value of the debt does not prejudge an optimal or sustainable level of the debt, which calculation would require to link the real cost of debt and the economic growth.

This threshold simply helps to locate the budgetary regime (Keynesian, non-Keynesian and anti-Keynesian) given of the external indebtedness level.

To test the hypothesis $H_0: \theta = 0$, we use under the assumption of the normality of errors the likelihood ratio statistic as the standard approach. The expression is as follows: $LR_T(0) = T\frac{S(W_1^0) - S(\breve{W}_1)}{S(\breve{W}_1)}$ (7)

Where $W_1^0$ is a residual sum squares of the model without le threshold (i.e. a linear model). For large values of $LR_T(0)$, the hypothesis $H_0: \theta = 0$ is rejected by the likelihood ratio test.

Insofar as that the null hypothesis $(\theta = 0)$ is specified for any arbitrary threshold value, the standard inference methods can not be resort by the test (i.e. the Fisher test inference).

Through stochastic simulations Hansen (2000) has succeeded in approaching asymptotic distribution function support of this it is possible to generate the p-value of the test statistics:

$$p_T = 1 - \left(1 - \exp(-\tfrac{1}{2}LR_T(0))\right)^2 \quad (8)$$

Thus, the critical values may also be calculated by inversing the distribution function.

The hypothesis $H_0$ is rejected, for a significance level $\alpha$, if the statistic $LR_T(0)$ is greater than the critical value $c(1-\alpha) = 2\ln(1-\sqrt{1-\alpha})$ .

### 5. Results and discussion

We will present in Table (3) the results of the deficit threshold value tests of equation (3) and its financing of equation (4). The result of the test indicates, with the minimum possible risk, that the assumption of a threshold of 1% of the deficit cannot be rejected. Beyond this threshold, the impact of the budgetary deficit on growth could be deferent.

**Table (2) Deficit and its Financing Threshold Effect Test**

| *Threshold* | | *Symbol* | *Value (% GDP)* | *LR (0)* | *p-value* |
|---|---|---|---|---|---|
| *Budget Deficit* | *Equation (3)* | *B_def* | *1%* | *95.8* | *0.000* |
| *External financing* | *Equation (4)* | *Ext_fin* | *2.6%* | *90.7* | *0.000* |
| *Internal financing* | | *Int_fin* | *-1.6%* | | |

**Note**: *In order to find the value of the deficit threshold, we run successive values of the deficit from the smallest to the largest value, separated from each other by an interval of 0.5% of GDP.*

*The same procedure is used to determine threshold values for internal and external financing, we choose the values which the sum is equal to 1% i.e. the used threshold value for the deficit.*

*The LR (0) ratio distribution does not have Fisher's standard properties, but its associated p-value can be calculated using its distribution function (see Hansen 2000).*

$p - value = 1 - (1 - exp(-0.5(LR(0))))$

*The budget deficit and its internal and external financing are expressed in percentage of GDP. A financing capacity is indicated by a negative value of these variables while a financing need is indicated by a positive value of these variables.*

The optimal thresholds are -1.6% and 2.6% when the deficit is replaced respectively by its internal and

external financing with a risk of error almost non-existent. Based on the results of the Hansen test, it is easy to analyze the estimations series presented in Table 5. In order to eliminate the endogenous nature of budgetary variables, the estimations are made by using the Instrumental Variables (VI) method. Indeed, it is sensible to assume the existence of a reaction function of budgetary policy mainly dependent on the fluctuations of economic activity, and that could cause a correlation between budgetary variables and the error term. The first column corresponds to equation (3) while the second column refers to equation (4). For each case, the excluded budgetary category corresponds to (current expenditure excluding interest on the debt). The estimated coefficient of each budgetary variable measures the net impact (unknown) of an increase in current expenditures excluding interest.

For example, the budgetary revenue coefficient measures the impact on growth of an increase in this necessary resource to finance an equivalent of current expenditure excluding interest.

**Table (3) Budgetary and growth factors: nonlinear effect**

| *Instrumental Variable Method Estimation*<br>*Instrumental variables list: the lagged explanatory variables*<br>*Sample: all variables are annual and cover the period from 1992 to 2016*<br>*Dependant variable Growth reel GGDP* | | |
|---|---|---|
| | [A] | [B] |
| *Control variables* | | |
| *P_Inv* | 0.053 [1.97] | 0.051 [1.93] |
| *Rain* | 0.030 [1.45] | 0.043 [1.82] |
| *Budgetary variables* | | |
| *B_Rev* | -0.238 [1.22] | -0.182 [0.55] |
| *Grant* | -1.348 [2.43] | -1.248 [2.04] |
| *Int_Debt* | 0.906 [1.25] | 0.787 [0.91] |
| *Cap_Exp* | -1.167 [3.41] | -1.318 [3.52] |
| *Res_Exp* | 1.746 [3.43] | 2.309 [3.65] |
| *B_Def* | 0.592 [3.72] | |
| *[B_Def -0.01]* | -1.117 [5.45] | |
| *Ext_Fin* | | 0.296 [1.32] |
| *[Ext_Fin-0.026]* | | -1.108 [3.59] |
| *Int_Fin* | | 0.739 [2.62] |
| *[In_Fin+0.016]* | | -0.901 [2.79] |
| | | |
| *N* *23* | | 23 |
| *Adjusted R-squared* | 0.79 | 0.76 |

**Note:** *The results of the estimation of the threshold models appear in columns [A] and [B] according to the results of the threshold effects tests, a deficit threshold value of 1% of GDP is introduced in the first model (column [A]). For internal and external financing, the threshold values are -1.6% and 2.6% of GDP respectively introduced in the second model (column [B].*

*Values in brackets are t-statistics in absolute terms.*

As we know that the statistical properties of the model remain invariant whatever the excluded variable, we can deduce that the choice of the excluded variable is arbitrary. Thus, all net coefficients can be found by substitution between different versions of the model. This is clearly perceived by examining the results reported in Table (4), where the same sample was used to re-estimate the model in (column [A]) of Table (3), whit the excluded budgetary variable in turn. To lighten the paper, we have not represented the regressions associated with the second column of the table (3). Overall, the results in Table (3) show that the statistical characteristics are reasonable and the robustness of the model is satisfactory. However, the order of magnitude of the coefficients seems high compared to other studies carried out on a large panel of developing countries. This may reflect the obvious dependence of Mali's economic growth in the choice of budgetary policy of the state. The results from table (3) of the column [A] indicate that it is better to reduce interest on debt and residual expenditures to finance an additional increase in current expenditure excluding interest, than to use a compensatory reduction in capital expenditures, or an increase in budgetary revenues, or grant. The (B_Rev) coefficient implies that the financing by the budget revenue of 1% increase in current expenditure excluding interest leads to a decrease in economic growth of 0.138%.

**Table 4 Budgetary and growth factors:**

*Instrumental Variable Method Estimation*
*Instrumental variables list: the lagged explanatory variables*
*Sample: all variables are annual and cover the period from 1992 to 2016*
*Dependant variable Growth reel GDP*

| *Excluded budgetary variable* | *B_Rev* | | *Grant* | | *Cu_Exp_ExcI* | | Int_Debt | | *Cap_Exp* | | *Res_Exp* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [A] | | [B] | | [C] | | [D] | | [E] | | [F] | |
| | coef | tstat | coef | tstat | coef | tstat | coef | tstat | coef | tstat | coef | tstat |
| *Control variables* | | | | | | | | | | | | |
| *P_Inv* | 0.053 | [1.97] | 0.053 | [1.97] | 0.053 | [1.97] | 0.053 | [1.97] | 0.053 | [1.97] | 0.053 | [1.97] |
| *Rain* | 0.030 | [1.45] | 0.030 | [1.45] | 0.030 | [1.45] | 0.030 | [1.45] | 0.030 | [1.45] | 0.030 | [1.45] |
| *Budgetary variables* | | | | | | | | | | | | |
| *B_Rev* | | | 1.209 | [2.61] | -0.238 | [1.22] | 0.768 | [1.23] | 1.028 | [4.58] | 1.517 | [3.35] |
| *Grant* | -1.209 | [2.61] | | | -1.348 | [2.43] | -0.541 | [1.52] | 0.281 | [0.76] | 0.497 | [0.69] |
| *Cu_Exp_ExcI* | -0.238 | [1.22] | -1.348 | [2.43] | | | -0.906 | [1.25] | 1.167 | [3.41] | -1.746 | [3.43] |
| *Int_Debt* | 0.768 | [1.23] | -0.541 | [1.52] | 0.906 | [1.25] | | | -0.360 | [0.72] | -0.939 | [1.11] |
| *Cap_Exp* | 1.028 | [4.58] | 0.281 | [0.76] | -1.167 | [3.41] | 0.360 | [0.72] | | | -0.679 | [1.26] |
| *Res_Exp* | 1.607 | [3.35] | 0.497 | [0.69] | 1.746 | [3.43] | 0.939 | [1.11] | 0.679 | [1.26] | | |
| *B_Def* | 0.629 | [4.18] | 0.929 | [5.52] | 0.592 | [3.72] | 2.728 | [4.23] | 0.810 | [6.06] | 1.037 | [4.23] |
| *B_Def-0.01* | -1.117 | [5.45] | -1.117 | [5.45] | -1.117 | [5.45] | -1.117 | [5.45] | -1.117 | [5.45] | -1.117 | [5.45] |
| | | | | | | | | | | | | |
| *N* | *23* | | *23* | | *23* | | *23* | | *23* | | *23* | |
| *Adjusted* $R^2$ | 0.79 | | 0.79 | | 0.79 | | 0.79 | | 0.79 | | 0.79 | |

Table (4) measures the effect on economic growth of financing any budget category.

An examination of the coefficients in the line relative to the grant variable, shows that a reduction in budgetary revenues offset by an equivalent increase in grant has a negative effect on growth. Similarly, grant financing from an increase in current expenditures excluding interest and interest on debt is not conducive to economic growth. In addition, an increase in capital expenditure or residual expenditures funded by grant has a positive effect on growth. The line corresponding to the (B_Rev) variable indicates, that the impact on growth of budgetary revenues financing of an increase in capital expenditure is favorable to growth, contrary to an increase in current expenditure excluding interest financed by the budgetary revenues.

The focus point of this work is to analyze the impact of budget deficit on growth. The positive sign of the variable budget deficit column [A] of the table (3) means that financing the budget deficit by an increase in current expenditure excluding interest is favorable to growth. However, when we consider a deficit above its threshold value of 1% of GDP in accordance with the results of the Hansen test, the results indicate that a marginal increase in the deficit deteriorates economic growth. As an example, from a balanced or surplus budget, if the government increases its deficit by 1% of GDP, then growth can increase by half a percentage point (0.592%). On the other hand, if the deficit is beyond its threshold value 1% of GDP, an increase of 1% deficit causes a loss of growth 0.525% (0.592 -1.117 = -0.525).

However, we must keep in mind that the threshold value of the budget deficit does not necessarily constitute a critical point that maximizes economic growth and for the following reasons.

The first reason is that even if the threshold level remains fixed at 1% of GDP, the effect on growth on either side of this threshold is strictly net of the effect of the excluded budget variable. The magnitude (and even the sign) of the effect of an increase in the budget deficit around its threshold value depends on the decrease in the category of resources that its compensates or the increase of the expenditures that its finances. To prove this, we use Table 5. Different versions of the model in column [A] of Table 3 have been estimated by varying the choice of the excluded variable.

**Tableau 5 the net effect of budget deficit on growth**

| *Excluded budgetary variable* | *B_Rev* | | *Cu_Exp_ExcI* | | *Cap_Exp* | | *Res_Exp* | |
|---|---|---|---|---|---|---|---|---|
| | *[A]* | | *[C]* | | *[E]* | | *[F]* | |
| | *coef* | *t-stat* | *coef* | *t-stat* | *coef* | *t-stat* | *coef* | *t-stat* |
| *Budget deficit <= 1% of GDP* | *0.629* | *[4.18]* | *0.592* | *[3.72]* | *0.810* | *[6.06]* | *1.037* | *[4.23]* |
| *Budget deficit > 1% of GDP* | *-0.588* | *[5.45]* | *-0.625* | *[5.45]* | *-0.407* | *[5.45]* | *-0.180* | *[5.45]* |

Note: *the values between bracket represent the t-statistic in absolute terms*
*The coefficients in this table represent the semi-elasticities of growth to the relative budget deficit. Easily, we notice that the second column of this table corresponds to the first column of table 3 and the third column of table 4. The column [A], [C] and [E] are distinguished from the column [B] by the simple fact of changing the excluded budgetary variable.*

For the 4 cases in Table 5, the existence of a regime change around the threshold value cannot be refuted. Nevertheless, the magnitude of the change varies according to the excluded budget variable. In fact, above its threshold level of 1% of GDP, an increase in the budget deficit has a negative effect on activity, especially when

it finances an additional amount of current expenditure excluding interest or offsets some marginal decrease budget revenues. The negative effect on growth is less important when additional amounts of deficit (over 1%) are intended to finance the residuals expenditures. It should be added that there are situations where the deficit may continue to have a positive effect on economic growth even after it has exceeded its threshold level. In this case, the threshold is not a point of change in the budgetary policy regime but rather a change in the slope of this regime.

The second reason is that, according to the results of the Hansen test, the value of the deficit of 1% of GDP seems to be optimal only when it corresponds to internal and external financing respectively of -1.6% and 2.6% of GDP. In this case, any other combination of internal and external financing would not be optimal.

Table 3 shows in column [B] that the effect on growth of the financing of a current expenditure surplus by external borrowing is positive when these external borrowing are initially below their threshold level 2.6% of GDP. Above this threshold level, the financing of external borrowings by increasing current expenditure has a negative effect on growth.

The interpretation of the internal financing follows the same reasoning. However, the sign and order of magnitude of this threshold value imply that the government accounts must constantly generate substantial domestic savings corresponding to a surplus of the basic fiscal balance close to 1.6% of GDP. Finally, the analysis of the impact of budgetary policy (especially the budget deficit) on growth must be conducted conditional on the evolution of the stock of public debt.

**Table 6: threshold effect test of budgetary policy, conditional on debt level.**

| *variable* | | *Symbol* | *Value (% GDP)* | *LR (0)* | *p-value* |
|---|---|---|---|---|---|
| *External debt* | *Equation (4)* | *Ext_debt* | *67%* | *25,10* | *0.000* |

The Hansen test presented in Table 6 does not reject the hypothesis of a debt threshold conditioning the impact of differentiated budgetary policy. The test suggested that the change in fiscal policy comes at a level of external debt corresponding to 67% of GDP.

**Table 7: Estimation of the impact of the budgetary policy on growth, conditional on external indebtedness level.**

| *Instrumental Variable Method Estimation*<br>*Instrumental variables list: the lagged explanatory variables*<br>*Sample: all variables are annual and cover the period from 1992 to 2016*<br>*Excluded variable: Current expenditure excluding interest on debt*<br>*Dependant variable Growth reel GDP* | | |
|---|---|---|
| | Coefficient | t-statistic |
| *Control variables* | | |
| *P_Inv* | 0.153 | [1.86] |
| *Rain* | 0.156 | [3.15] |
| *Budgetary variables* | | |
| *B_Rev* | -0.340 | [2.02] |
| *Grant* | -0.454 | [1.50] |
| *Int_Debt* | 1.191 | [0.91] |
| *Cap_Exp* | 1.020 | [1.60] |
| *Res_Exp* | 1.392 | [2.14] |
| *B_Def_inf (67%)* | 0.280 | [1.91] |
| *B_Def_sup (67%)* | -1.161 | [2.90] |
| | | |
| *N* | *24* | |
| *Adjusted R-squared* | 0.65 | |

Note: *Values in brackets are t-statistics in absolute terms.*

In Table 7 we have an overview of the influence of budgetary policy conditioned by the indebtedness variable. The impact coefficients are indeed distinct signs depending on whether the level of indebtedness is lower or higher than 67% of GDP. In the first case where the indebtedness regime is qualified as normal, the coefficient of (*B_Def_inf*) having a positive sign and significant, reflects a Keynesian budgetary situation. In critical regime, the correlation between budgetary policy (*B_Def_sup*) and economic growth is negative and statistically. Therefore, this regime can be described as anti-Keynesian.

## 6. Conclusion

This article attempts to analyze empirically the non-linear effects of budgetary policy on Mali's economic growth.

For this, we have located the institutional benchmarks, since the implementation of adjustment policies to show the context in which the budgetary policy could evolve, but also to determine its relationship to growth. We have developed a literature review of non-linear budgetary policy concept. We distinguish three schools of thought: The first school is Keynesian and encourages expansionary budgetary policy as growth acceleration factor. The second school is called Classical Neutral, it argues that budgetary policy has no effect on growth. And finally, the third school is Anti-Keynesian, it bases its arguments on the recessive nature of the budgetary policy.

The point cloud shown in Figure 1, allows to make a preliminary analysis whose empirical verification is supported by suggesting the presence of a non-linear relationship between budgetary policy and economic growth. In a more robust way, the econometric analysis, based on the rigorous state budget constraint, confirms the existence of this non-linear effect and robustly identifies a deficit threshold from which growth reacts differently to the budgetary policy. This deficit threshold is estimated at 1% of GDP. It follows that, when the deficit is below this threshold value, any increase in the deficit leads to growth GDP, an opposite effect will occur when the deficit is above this threshold value.

Regarding the loss of growth beyond the threshold level, they are related to the nature of expenditures or revenues that the deficit seeks to finance. The losses are greater when the budget deficit is used to finance a fall in budget revenue or an increase in current expenditure, than when it is used to finance a surplus of capital expenditure. Its depend on the composition of the deficit in terms of external and internal financing. It would be judicious that the optimal deficit threshold to be composed of an external financing threshold of 2.6% GDP and an internal financing of -1.6% of GDP. However, it is not enough to observe the deficit level to know whether it needs to be the increase or decrease to accelerate growth, but rather its levels of financing that should be subject to careful control.

The study shows that the relationship between budgetary policy and economic growth is Keynesian when the external indebtedness ratio is below 67% of GDP. For an indebtedness higher than this threshold, the relationship is rather anti-Keynesian.

Mali's current level of public external debt is around 17.4% of GDP. The growth would be favorable to an expansionary budgetary policy. However, we must not draw this conclusion hastily without considering the constraints on the budget deficit or its financing. These constraints are tighter than those affecting the external debt ratio.

The study also shows that the convergence mechanism implemented within WAEMU should not only be part of a logic of nominal inking with the European currency. The budgetary rules established under the Stability and Growth Pact should be thorough studies based on a rigorous treatment of statistical and economic data. The methodology for determining threshold effects is applicable to all countries in the zone. It would firstly allow to determine the specific characteristics of each country and also to establish Community rules on a suitable scientific basis.

Finally, it is important to note that the analysis proposed in this work is focused on the short term since it does not take into account the budgetary adjustment strategies. In particular, a reduction in public sector size, whose expected effects only appear in the long term.

We can go further into this study by seeking to determine the existence of threshold effects at the level of other budget categories such as current expenditure or budget revenues. It is up to the modeler to decide on the choice of budget categories and to proceed to another budget breakdown by including other equally relevant such as wage or subsidies.

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