

Determining Optimal Thresholds for Macroeconomic Indicators in DRC (Congo). An Analysis of Macroeconomic Convergence Criteria in SADC, COMESA and ECCAS

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Abstract

The aim of this article is to determine for the DRC, the optimal levels of four macroeconomic indicators (inflation, budget balance as a percentage of GDP, public debt as a percentage of GDP and international reserves in months of imports) used as convergence criteria in three Regional Economic Communities (RECs), namely SADC, COMESA and ECCAS. The threshold model is used as an empirical model to calculate the optimal level for each indicator. The results suggest that the optimum levels of these indicators for the DRC deviate significantly from the convergence criteria set by most of the RECs of which the country is a member. This raises the question of the relevance for the DRC of complying with these criteria, which would restrict its scope for action, particularly to promote growth and development.

Keywords

Macroeconomic Indicators, DRC, Threshold Model

1. Introduction

Regional economic integration is an irreversible process for Africa, for which the main responsibility for implementation lies with the regional economic communities (RECs) and their member states. To date, Africa has fourteen (14) distinct regional economic communities and several countries are characterized by multi-membership of existing sub-regional groupings. It is generally accepted that membership of several regional economic communities or several free trade agreements hampers the integration process through the existence of inconsistencies that undermine the efficiency of the process. Indeed, several studies have

empirically demonstrated that the multiple memberships of countries in different integration zones compromise the effectiveness and efficiency of the regional economic integration process in Africa (Gunning, 2001; Yang & Gupta, 2005; Kuhlmann & Mwangi, 2012; Chacha, 2013). In addition, the Democratic Republic of Congo (DRC) is a member not only of 5 different sub-regional economic groupings (ECCAS, SADC, COMESA, CEPGL and EAC) but has also joined the Program for Monetary Cooperation in Africa (PCMA) through the Central Bank of Congo. As such, it is bound by the macroeconomic convergence criteria set by the RECs, which do not seem to reflect the specific characteristics, potential and constraints of each country. Seen from this angle, it therefore seems important for members of the RECs, especially those belonging to several simultaneously, to determine and analyze their optimum thresholds for the macroeconomic convergence criteria, as ignorance of these could lead to inefficiency in meeting these requirements. Furthermore, strict adherence to the various convergence criteria as set out in the RECs, without knowledge of one's own optima, could lead to a willful misguidedness described as a lack of foresight. This state of affairs makes it impossible to assess the benefits and losses of belonging to a REC.

In view of this situation, it is important to determine empirically for the DRC the thresholds for the macroeconomic variables that are part of the convergence criteria as defined in the various RECs. The aim of this article is therefore to use DRC-specific data to determine the optimal levels for inflation, the budget deficit, the level of international reserves and public debt. The originality of this article can be perceived through the use of quantitative tools in determining the threshold levels of economic variables for the DRC, on the one hand, and the comparison of these thresholds found with the nominal convergence criteria adopted by the SADC, COMESA and ECCAS, on the other hand, in order to show that the thresholds as currently fixed by the RECs are not optimal and that there would be exploitable margins for the DRC.

The remainder of the paper is presented as follows. Section 2 provides a brief review of the empirical literature on the determination of optimal thresholds. Section 3 presents the methodology. The results are given in Section 4 and Section 5 concludes the paper.

2. Literature Review

A review of empirical work on optimal thresholds generally highlights the importance of four (4) macroeconomic indicators, namely the optimal inflation threshold (Sarel, 1996), the optimal reserve threshold in months of imports (Mendoza, 2004), the optimal deficit threshold as a percentage of GDP (Onwioduokit, 2012) and the optimal public debt threshold as a percentage of GDP (Mupunga et al., 2015). The search for the optimal level of inflation in an economy follows theoretical debates between those who argue that a given level of inflation would be an essential driver of economic growth while others believe that inflationary effects would be detrimental to economic growth. The consensus

that moderate inflation contributes to economic growth nevertheless raises another pertinent concern, namely the existence of an optimal level of inflation above which the inflation-growth relationship is negative and below which the relationship is positive (Fisher, 1993). Several studies have attempted to empirically determine the optimal level of inflation using a threshold model with panel data. Sarel (1996) is considered to be the pioneer in this investigation, using a panel of 87 countries for the period 1970-1990, and points to the existence of a structural break in the relationship between inflation and economic growth in industrialized countries above the 8% threshold. The study by Ghosh and Phillips (1998), based on a large sample of OECD and developing countries, shows that the optimal inflation threshold is between 2% and 8% for OECD countries and between 5% and 10% for developing countries.

However, it has been noted that the majority of empirical studies are based on panels that sometimes include countries with different levels of development and economic structures. Thus, as suggested by Lin and Ye (2009) and Espinoza et al. (2010), it is important for developing countries to carry out empirical tests that consider each country individually. For their part, Hussain and Malick (2011) suggest an optimal inflation threshold of 9%, while Nasir and Saima (2010) had estimated two inflation thresholds of 6% and 11% for Pakistan by splitting the sample into two categories. Fabayo and Ajilore (2006) use time series data from 1970 to 2003 to study the inflation-economic growth relationship in Nigeria. The results found indicate an optimal inflation threshold of 6%, beyond which any increase in inflation leads to a fall in economic growth. Using Hansen's (1999) approach, Munir et al. (2009) find an optimal threshold of 3.89% for the Malaysian case from 1970-2005, Adusei (2012) finds a threshold of 7% for South Africa between 1965 and 2010, above which the economic growth rate is significantly reduced. In his analysis of the presence of threshold effects in the relationship between growth and inflation for Rwanda, Rutayisire (2015) estimates a quadratic model as specified by Pollin and Zhu (2005) and Quartey (2010). Using annual frequency data from 1968 to 2010, he finds a threshold of 14.97% below which inflation is not harmful to economic growth. This result is higher than the 5% threshold set by Rwanda's monetary authority.

Studies highlighting the importance of the optimal reserve threshold in months of imports show that the pursuit of the objective of macroeconomic stabilization drives countries to build up international reserves to give the monetary authorities the possibility of intervening in the foreign exchange markets and guaranteeing all external payments. Over the last decade, the accumulation of reserves has become an objective in its own right and a key factor in international relations for developing countries and emerging economies. In general, countries hold reserves in order to smooth exchange rate fluctuations effectively, reduce the adjustment costs associated with fluctuations in international payments, guard against the instability and uncertainty of external capital flows and reassure investors, thereby stimulating investment and growth. Thus, the rule for

most countries is to maintain reserves covering at least three months of imports (Mendoza, 2004). However, achieving this objective involves sterilization costs, since the interest generated by investing these reserves is less than the gains that could be generated by investment projects using these reserves. In these circumstances, it is essential for countries to determine the optimal level of reserves that minimizes costs and maximizes gains, with a positive effect on economic growth.

Empirically, the literature review on determining the optimal level of international reserves remains sparse, with most researchers focusing on the relationship between reserve accumulation and economic growth without giving a clear indication of the threshold. Like Kashif et al. (2020) who examine the linear and non-linear causalities between international reserve accumulation and economic growth in India. Using the augmented Dickey-Fuller (ADF) unit root test, Granger linear causality test, Johansen cointegration test, Brock, Dechert and Scheinkman (BDS) test applied to quarterly data ranging from 1985 to 2014, the study establishes the existence of a non-linear bidirectional causality between reserve accumulation and economic growth and concludes that reserve accumulation can be implemented in India provided that excess reserves are invested in alternative sources such as economic infrastructure projects and regional infrastructure development.

Following the same logic, Law et al. (2019) test the threshold effect of the degree of financial integration on the relationship between monetary independence and foreign exchange reserve. Using a linear threshold model compared to cross-sectional data from 55 developed and developing countries from 2012 to 2014, find that foreign exchange reserves must be maintained above a certain threshold for economies to achieve monetary independence and financial integration. Nwachukwu et al. (2016) analyse with a threshold vector error correction model the long-run relationship between external reserves and exchange rates in Nigeria using daily data from 2014 to 2015. The results found indicate a long-run non-linear relationship between the two variables and that above the established threshold, both confirm cointegration. Very recently, Oloo et al. (2022) determine the threshold effects of macroeconomic convergence criteria on the real GDP growth rate of the East African Community (Kenya, Tanzania, Uganda, Rwanda and Burundi). Using a dynamic threshold panel model applied to a sample of data from 2005 to 2020, the results found indicate an optimal reserve threshold of 4 months of imports below the 6-month target set by the Monetary Committee. The work concludes that the economies of EAC member countries are performing well below the target level.

Furthermore, the nature of the relationship between the budget deficit and economic growth remains a major concern in economic debates. Recent empirical literature on the budget-growth link seeks to determine the optimal level of the deficit that maximizes growth and beyond which the budget-growth link becomes negative. Onwioduokit (2012) determines the relationship between the

budget deficit and economic growth in Guinea. The results indicate the existence of a positive relationship between the budget deficit and economic growth in Guinea and that the budget deficit threshold conducive to economic growth has been identified at 3.0%. Similarly, [Onwioduokit and Bassey \(2014\)](#) estimated the level of fiscal deficit conducive to growth in The Gambia. Using the threshold autoregressive model (TAR), the results identify a budget deficit threshold at 6.0%.

[Akosah \(2013\)](#) used quarterly data from 2000 to 2012 to examine the threshold effect of the budget deficit on economic growth in Ghana using a semi-parametric or semi-linear model proposed by [Khan & Ssnhadji \(2001\)](#). The results indicate that a deficit in excess of 4% of GDP is detrimental to economic growth. [Aero and Ogundipe \(2016\)](#) examine using a threshold autoregressive model (TAR) the effects of budget deficits on economic growth in Nigeria from 1981 to 2014. Their results indicate a threshold of 5% conducive to economic growth and suggest an increase in public capital expenditure until ensuring that the 5% deficit is maintained. In their study of Ghana covering the period 1967-2013, [Alagidede et al. \(2018\)](#) find, using Hansen's modelling [Hansen \(1999\)](#) an optimal budget deficit threshold of 7.6% of GDP. Recently, [Chebiwott and Mwangangi \(2021\)](#) examined the budget deficit threshold on economic growth in Kenya on annual data from 1985 to 2015 and showed that the budget deficit has a positive effect on growth as long as it does not exceed the threshold of 5% of GDP.

Finally, several approaches are used empirically to model the relationship between public debt and growth. In this regard, [Mupunga et al. \(2015\)](#) examine the optimal threshold for maximizing the growth rate in Zimbabwe using a quadratic model. The analysis leads to a public debt/GDP ratio of between 45% and 50% of GDP. [Omotosho et al. \(2016\)](#) found a non-linear relationship between public debt and economic growth in Nigeria over the period 2005-2015. The results show that for a debt ratio of less than 73.7%, public debt has a positive impact on economic growth. However, above this threshold, any accumulation of public debt has adverse effects on growth in Nigeria.

3. Empirical Methodology

As the determination of optimal thresholds for macroeconomic variables in the Congolese economy is one of the primary criteria of the various RECs, the threshold model formulation is used in this study. This class of models is an alternative to linear models in order to capture the abrupt breaks or asymmetries observed in most macroeconomic time series over a business cycle. The aim is to determine the optimal levels of the variables inflation, public debt/GDP ratio, reserves in months of imports and deficit/GDP ratio that maximize economic growth in the DRC. Most threshold models include an autoregressive component as in the specification. In general, a threshold effects model with two regimes is presented as follows:

$$y_t = X_t\beta + Z_t\delta_1 + \epsilon_t \quad \text{si } -\infty < w_t \leq \gamma \quad (1)$$

$$y_t = X_t\beta + Z_t\delta_2 + \epsilon_t \quad \text{si } \gamma < w_t < \infty \quad (2)$$

where y_t is the dependent variable, X_t is a $1 \times k$ vector of autoregressive values of y_t , Z_t is a $k \times 1$ vector of threshold invariant parameters, ϵ_t is the error term following iid with zero mean and variance σ^2 , Z_t is a vector of variables with coefficients of specific regimes δ_1 and δ_2 , and w_t is the threshold variable of the vector X_t or Z_t . β , δ_1 and δ_2 are parameters of interest. On the other hand, the Conditional Least Squares (CLS) method estimates the parameters and calculates the threshold by minimizing the sum of squared residuals (SCR) obtained for all candidate thresholds.

This methodology takes into account three groups of variables. The first group provides information on the dependent variable (1 variable), the second group concerns the variables of interest (4 variables) and the third group concerns the control variables (4 variables). The economic growth rate of real GDP is used as the dependent variable. The interest explanatory variables concern the inflation rate, public debt, international reserves and the public deficit. The explanatory control variables provide information on Foreign Direct Investment, the demographic growth rate and trade openness. Several sources of data are used to produce an elaborate statistical compilation. The data used are mainly provided by the Central Bank of Congo (BCC) and the World Economic Outlook (WEO). These data are quarterly and cover the period from 2009 to 2021. **Table 1** below gives a description of the different variables selected for the empirical analysis.

Table 1. Variables definition.

Variables	Measure	Sources
Dependent variable		
Real GDP rate	Variation of real GDP from one year to the next	World Economic Outlook (WEO)
Variables of interest		
Inflation rate	Change in consumer price index from one year to the next	Central Bank of Congo
Public debt	Ratio of outstanding public debt to nominal GDP expressed as a %	Central Bank of Congo
International reserves	Level of international reserve cover in months of imports	Central Bank of Congo
Public deficit	Public deficit as a % of nominal GDP	Central Bank of Congo
Control variables		
Foreign Direct Investment	Foreign direct investment as a percentage of GDP	World Economic Outlook (WEO)
Demographic growth rate	Variation in population size from one year to the next	World Economic Outlook (WEO)
Trade openness	Total of exports and imports over GDP	Central Bank of Congo

Source: Author.

4. Results and Discussion

We present and discuss the results in two stages. Statistical evidences based pri-

marily on the variables of interest are presented first, while the econometric results are presented and discussed second.

- **Statistical evidence**

The Congolese economy remains dependent on the global environment and the ability of the authorities to strengthen its resilience. This is reflected in trends in the most relevant macroeconomic indicators, notably inflation, the public deficit, foreign exchange reserves and debt. As far as inflation is concerned, it should be noted that it has accelerated during periods of crisis. Indeed, the Government's efforts at disinflation in the early 2000s, after a decade of hyperinflation in the 1990s, were undermined by the repercussions of the 2008-09 financial crisis, combined with public finance imbalances. Between 2008 and 2012, the economy experienced double-digit inflation, averaging around 25%, attesting to the persistence of the effects of these two shocks. The effects of these shocks dissipated from 2013 onwards against a backdrop of prudent fiscal policy, evidenced by a cash-based management policy. Thus, fiscal policy combined with a favourable global environment helped to contain inflationary pressures.

Between 2013 and 2015, actual inflation was below 2%, at levels not seen since independence, with a low of 0.8% in 2014. However, the lull observed on the goods and services market for almost 4 years quickly faded in 2016-2017 as a result of the repercussions of the fall in world commodity prices, mainly those exported by the DRC. This shock created external and public finance imbalances, which fueled inflationary pressures. Inflation rose from 1.0% in 2015 to 11% and 54.7% in 2016 and 2017 respectively. The stabilization measures taken by both the Government and the Central Bank of Congo have helped to break the acceleration in the rate of price formation, with a view to bringing inflation in line with the medium-term target of 7%. However, with the onset of the health crisis linked to the Covid-19 pandemic in 2020, inflation accelerated once again, against a backdrop of disruptions to supply chains as a result of the movement restriction measures taken to stem the spread of the pandemic. In 2020, inflation reached 15.8%, compared with 4.6% in 2019, before slowing in 2021.

With regard to the public debt/GDP ratio variable, it is worth noting the resumption of cooperation with the Bretton Woods Institutions, which enabled the DRC to obtain external debt relief in 2010, thanks to the Heavily Indebted Poor Countries (HIPC) initiative. The amount of its external debt has been reduced from around USD 13.0 billion to around USD 4 billion. As more than 80% of the country's public debt is external, this debt relief has reduced the debt/GDP ratio to below 20% on average between 2010 and 2021. In addition, following the cancellation of part of the debt, the Government's policy has been to give priority to concessional debt under the World Bank's IDA window, based on the results of the debt sustainability analysis. The public deficit-to-GDP ratio is well below the threshold set by the various RECs to which the DRC belongs. On average, the budget deficit will represent only around 1% of GDP between

2010 and 2021. This result is mainly due to the sound management of public finances, reflected in a rationalization of spending or an improvement in the quality of spending, combined with a policy of implementing spending on a cash basis. The Government's objective was to avoid the repercussions of the imbalance in public finances on both the goods and services market and the foreign exchange market. Indeed, economic history has shown that public finance imbalances have been the main source of accelerating inflation and the underperformance of the Congolese economy as a whole (**Figure 1**).

The overall trend in foreign exchange reserves has been upwards, thanks to the economic recovery reflected in solid growth above the average for sub-Saharan Africa, driven mainly by the extractive sector (mining). Mining remains the main foreign exchange earner, with world prices for export commodities such as copper and cobalt holding up well. However, despite the increase in foreign exchange reserves in nominal terms, import cover remained low compared with the convergence criterion defined by the RECs. Indeed, the DRC's foreign exchange reserves represented less than 2 months of imports of goods and services between 2009 and 2020, compared with 3 months and 6 months defined as the threshold by COMESA and SADC respectively. This situation is mainly due to the increase in the import bill, given the extraversion of the Congolese economy. As a reminder, the DRC exports nearly 80% of its consumer goods, particularly basic foodstuffs. In 2021, foreign exchange reserves reached a coverage of 3 months of imports, a level corresponding to the threshold defined in the ABCA's African Monetary Cooperation Program (AMCP). This development is due to a sharp increase in nominal reserves following disbursements by the IMF in support of the balance of payments under the three-year program supported by the FEC, as well as a policy of accumulating reserves conducted by the BCC. In addition, like other IMF member countries, the DRC benefited from around USD 1.4 billion in general Special Drawing Rights (SDRs) granted by the IMF Executive Board. The purpose of this allocation was not only to meet the long-term global need for reserve assets, but also to support the post-Covid global recovery.

- **Econometric findings**

The estimation result indicates the non-linear nature of the relationship between inflation and economic growth in the DRC, with an annual threshold of 9.96% that minimizes the sum of squared residuals (SCR). It can be deduced from this result that any inflationary surge below this threshold is beneficial to economic growth and gives more room for manoeuvre in achieving other macroeconomic objectives. In fact, the inflation threshold of the various RECs (COMESA, SADC and ECCAS) and the medium-term objective of 7% currently set by the Central Bank of Congo are below the estimated threshold. Hence the existence of a shortfall for the DRC supports its development (**Table 2**).

Table 3, on the other hand, also shows that the optimal import cover reserve threshold that minimizes the sum of squared residuals (SCR) found for the Congolese economy is 1.34 months. This level is well below the macroeconomic

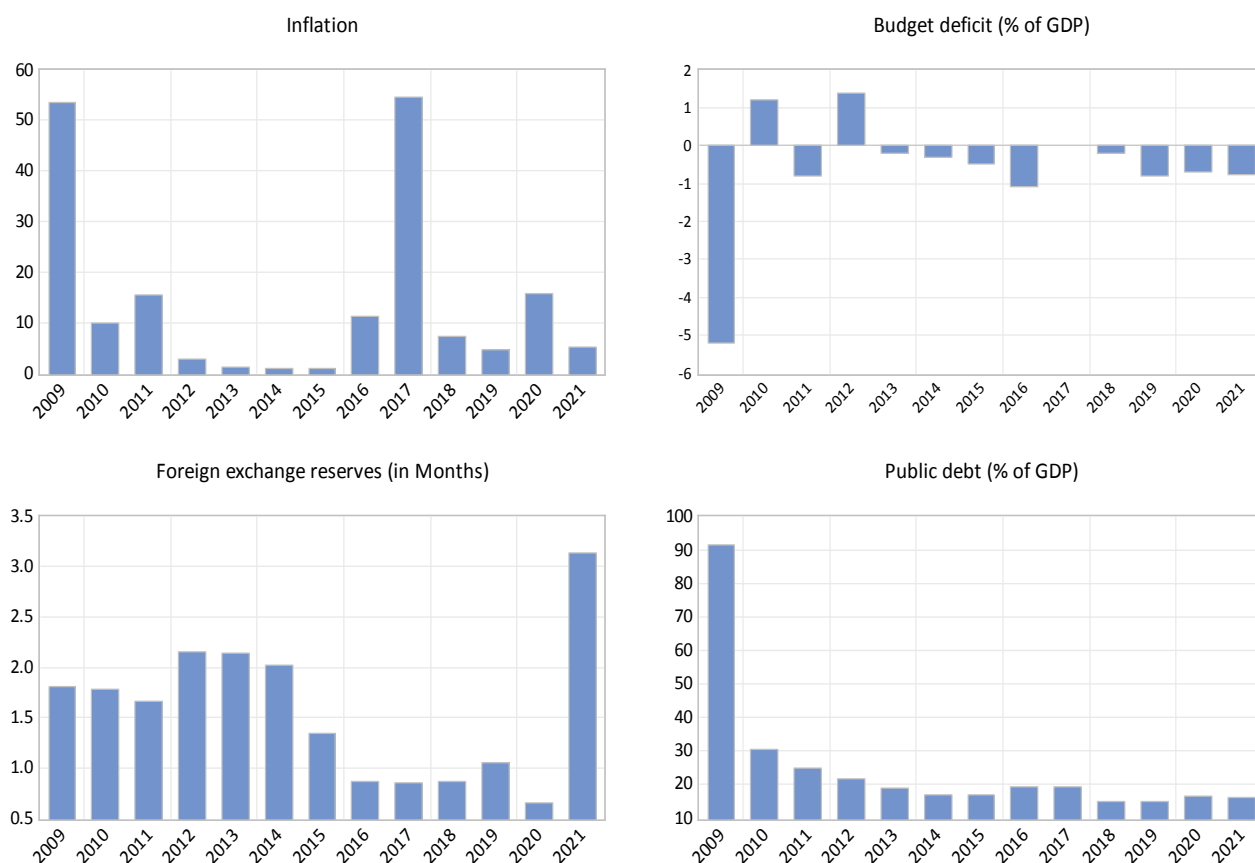


Figure 1. Trends in macroeconomic indicators in the DRC.

Table 2. Result of the regression.

Convergence thresholds indicators	INFLATION	RESERVES	DEFICIT	DEBT
Nombre of regime	2	2	2	2
Number of thresholds	1	1	1	1
Threshold	9.96%	1.340	4.370	
Quarterly thresholds				42.9302
SCR	0.0011***	0.0007***	0.0369**	0.0009***

Source: Computed by the author. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ are 1%, 5% and 10% levels of significance, respectively.

convergence criteria defined by the various sub-regional groupings to which the DRC belongs. However, the 6-month import cover currently defined by SADC and 3 months by COMESA and ECAC would be very restrictive, asphyxiating and sub-optimal for the DRC in view of the multiple economic challenges facing the country. Covering 6 months' worth of imports would be an unprecedented record and would also entail enormous sterilization costs and a loss of earnings on the investment projects that the country could finance with these reserves for the purposes of economic diversification. Indeed, the estimated threshold of 1.34

Table 3. Convergence thresholds for macroeconomic indicators: DRC vs RECs.

	DRC	SADC	COMESA	ECCAS
	Threshold	Criterion	Criterion	Criterion
Inflation	9.6	3 - 7 %	7%	3%
Foreign exchange reserves (in Months)	1.34	6	3	6
Budget deficit (% of GDP)	4.37	3%	5%	3%
Public debt (% of GDP)	42.93	60%	65%	70%

Source: Computed by the author. Note. % (Percentage).

months of imports, while low by CER standards, does not constitute a danger to the economy, and further accumulation efforts should be made with a view to financing large-scale economic and social projects. Nevertheless, this level could be adjusted to give the monetary authority the leeway and scope to intervene on the markets in times of crisis.

The result suggests the existence of a non-linear relationship between the budget deficit and economic growth with a threshold of 4.37%. Indeed, when the budget deficit does not exceed 4.37% of GDP, expansionary fiscal policy has a positive effect on economic growth. This result is close to those found by Akosah (2013), namely thresholds of 4% and 4.8% of GDP for Ghana and Morocco respectively. Chebiwott and Mwangangi (2021), Aero and Ogundipe (2016) and Onwioduokit and Bassey (2014) found the slightly higher optimal threshold of 5% of GDP for Kenya, 5% of GDP for Nigeria and 6% of GDP for The Gambia, respectively. Consequently, the convergence criterion of 3% GDP as set out in the various RECs is sub-optimal compared with the estimated threshold. The latter should provide the country with a budgetary margin for manoeuvre of around 1.37% of GDP, necessary to finance investment expenditure (basic infrastructure) for the transformation and diversification of the economy. The table above also shows the existence of a non-linear relationship between public debt and economic growth in the DRC, with a threshold of 42.93% close to the range of 45% - 50% estimated by Mupunga et al. (2015) for Zimbabwe. It should be noted that with the threshold found, the DRC has sufficient useful debt margins to finance investments. In fact, the debt-to-GDP ratio is 18% at the end of April 2023 (*Direction Générale de la Dette Publique, 2023*) which is lower than the sub-Saharan average due to the fact that it has reached the completion point of the Heavily Indebted Poor Countries Initiative (HIPC).

5. Conclusion

This study focused on determining, for the DRC, the optimal thresholds for the macroeconomic variables that form part of the primary criteria of the various RECs, namely inflation, the ratio of public debt to GDP, reserves in months of imports and the deficit/GDP ratio, which maximize economic growth in the

DRC. The threshold model was used, based in particular on a review of the empirical literature. The latter shows that the problem of the optimal inflation threshold at the level of individual countries very generally leads to double-digit inflation rates for developing economies. The review of the empirical literature on determining the optimal level of international reserves remains sparse, with most researchers focusing on the relationship between reserve accumulation and economic growth, without giving a clear numerical indication of the threshold. This analysis reveals the non-linear nature of macroeconomic variables, with thresholds of 9.6% inflation, 1.34 months of international reserves, 4.37% budget deficit and 42.93% public debt. It can be concluded that the criteria as currently set are non-optimal compared with the thresholds found for the DRC.

The limit of this research lies in the fact that it is restricted to three sub-regional groups (SADC, COMESA, ECCAS) while the DRC is also a member of the EAC. Another limitation resides in the fact that the work is limited only to the first rank criteria. A later study could strive to take into account the second criteria for a more complete analysis.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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