Threshold Effect of Macroeconomic Convergence Criteria on Real GDP Growth Rate within the East African Community

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ABSTRACT

This study investigates how the thresholds set by the East African Monetary Committee (EAMC) have impacted the growth of the East African Countries (Kenya, Tanzania, Uganda, Rwanda, and Burundi). The analysis establishes the actual thresholds supported by a panel data model, running from 2005 to 2020, which are drawn from World Development Indicators data from the World Bank website. The actual thresholds obtained are compared to the thresholds adopted by EAMC. This data was analysed using a Dynamic Threshold Panel model; the results show a slight deviation of the actual (optimal) data thresholds from the thresholds adopted as the EAC criteria for the formation of a Monetary Union. Therefore, there is need to reconsider the thresholds criteria to enable them to become feasible for the member states to achieve so as to form the Monetary Union.

Keywords: Budget Deficit, East African Community, External Reserves, GDP Growth, Inflation, Macroeconomic Convergence, Threshold Regression

I. INTRODUCTION

The East African Community (EAC) was reborn in 2000 after Kenya, Uganda, and Tanzania decided to revive it in 1999. The other member states, Burundi and Rwanda, later joined in 2007. The EAC was resuscitated to formulate policies and government programs that would enlarge and deepen cooperation between member states in economic, social, cultural, and political prosperity for the greater good of the member countries. The agreement stipulated that the member states shall work towards realizing a Customs Union and later a Common Market, which would lead to the eventual establishment of a Monetary Union (MU) and, finally, a Political Federation. The targeted goals were to strengthen economic governance and provide an environment that would hasten harmony and promote equitable economic development that is sustainable (EAC, 2007). These efforts indeed have resulted in forming a Customs Union, adopted in 2005, and a Common Market established in 2010.
Looking at the EAC region, the geographical area is approximately 1.82 million kilometres square with a population of roughly 133.1 million people that is rapidly growing. The East African region, whereby herein referring to Kenya, Uganda, Tanzania, Rwanda and Burundi for this study, has generally been realizing growth over time, although at different rates for the different states. The combined GDP, which stood at 5.4 billion in USD reported in 2005, increased to 212.2 billion USD by 2020. The latest individual country GDP per capita in USD is as shown in Fig. 1 above.

In the East African region, Kenya and Tanzania have a more robust economy than the other members, who also seem to grow equally rapidly. During the global economic crisis in 2008, the combined GDP growth of the East African countries’ economies dropped to 4.4% in 2009, but in 2010 it recovered to 5.9%. Analysing the region’s per capita GDP in USD, it increased on average from $364 in 2005 to $961 in 2020. The data indeed show EAC integration has increased trade amongst the member states since the re-establishment of the community. Kenya remains the primary source of imports for the member countries of the East African region; however, it registers a paltry quantity of exports to the member countries. Nevertheless, all the countries in the region register an unfavourable balance of trade whereby they import more than they export in general (EAC, 2019).

The African Union intended to elevate the existing Regional Economic Communities (REC) in the continent to Monetary Unions by 2015, whereby members in these unions were encouraged to consider the adoption of a single currency by the year 2015 (EAC, 2009). The benefits that countries in a monetary union are expected to accrue include reduced cross-border transaction costs, the exchange rates becoming less volatile, and increased trade and investment in the union. The initial stages of a regional community would bring about a common market, which is expected to result in free movement of goods and services, human resources, and capital, resulting in efficiency of production in the region and hence the overall benefit of growth in GDP. The region would also realise price stability and convergence in macroeconomic variables leading to a reduction in market disequilibrium, increased competition and economic efficiency (Bologun, 2009; Dunlap, 2013; Roger et al., 2012).

The vision of the EAC was to ensure that members realise a unifying and stable policy state after the monetary union; however, this is expected to come at costs to the members, which would range from; loss of a nation’s autonomy in implementing monetary policies, loss of exchange policy, to loss of fiscal independence (Calmfors, 2001; Nannyonjo & Asiimwe, 2014). The extent to which the countries will be affected by these gains and losses depends on the status before adopting the monetary union. For a monetary union to be beneficial, the region must have significantly realized macro-economic convergence and integration in the financial sector. Otherwise, incompatibility would result in high adjustment costs, and therefore the East African Monetary Union (EAMU) would be unstable or collapse.

Robert Mundell (1961) established the Optimum Currency Area (OCA) theory, which detailed that regions with particularly common economic virtues, even without sharing national borders, could benefit immensely by using a common currency. The theory posited that having a common currency by geographic or geopolitical regions rather than by country would increase efficiency. The approach set out four criteria that member countries must meet before joining a MU. The criteria are; integrated labour market, the flexibility of pricing, capital mobility, centralized budget control, and finally, similar business cycles.

Before realizing a monetary union, the practice has been that regions set macro-economic convergence criteria (within the context of this paper, are referred to as thresholds) that would guide the member states to realise the merger. EAC has also done the same where ceilings and bases have been set to guide macro-economic policies for the member states. These have been met with several challenges orchestrated by discrepancies in the member countries’ institutional, social, and economic frameworks. In this regard the Partner States formed a committee of the central bank governors of respective countries, the EAC Monetary Affairs Committee (EACMAC) with the mandate to oversee, coordinate and harmonise the macro-economic policies in the region. The other vital deliverables that they were expected to achieve included; making the value-added tax to be standard in the region, enhancing the ease with which one currency can be converted to another, installing modern and integrated payment and settlement systems, and having the trading practices and rules in the stock exchange market in the region synchronized (EAC, 2020).

However, the thresholds have faced low levels of commitment and, in some cases, as low as only three members out of five participating. The other challenge is to have a mechanism to coordinate inter-country operations to realise the set targets; each country runs its macro-economic policies through their respective governments in a very volatile economic environment making the realization of the convergences a pipe dream.
II. MACRO-ECONOMIC CONVERGENCE CRITERIA FOR THE EAC

The ultimate transition of the East African countries to a monetary union is highly anchored on the thresholds that have to be achieved for the member countries to realise macro-economic convergence and robust economic growth. The EACMAC sets and monitors the thresholds. The set guidelines are pretty comprehensive and comprise mainly traditional criteria and their derivatives which are further classified as to whether they are primary or secondary. The thresholds have to be met before the adoption of the monetary union. Subsequently, they must be maintained at two stages before adopting the monetary union in the third stage (Kuteesa, 2012). The floors and the ceilings for the targeted macro-economic variables are spelt out as in Table I below:

| Criteria                                      | Stage I 2007-2010 | Stage II 2011-2014 | Stage III 2015 |
|-----------------------------------------------|-------------------|--------------------|----------------|
| Primary Criteria                              |                   |                    |                |
| Budget deficit/GDP (excluding grants)         | <6%               | <5%                |                |
| Budget deficit/GDP (including grants)         | <3%               | <2%                |                |
| External reserves (months of imports of goods and non-factor services) | >4                | >6                 | Introduction and circulation of a single East African currency |
| Annual inflation rate                          | <5%               | <5%                |                |
| Secondary Criteria                            |                   |                    |                |
| Exchange rates                                | Stable            | X                  |                |
| Interest Rates                                | Stable            | X                  |                |
| Real GDP growth rate                          | >7%               | >7%                |                |
| National savings/GDP                          | >20%              | >20%               |                |

Source: EAC Monetary Affairs Committee (MAC) report, 2009; X implies that the criterion is considered for that stage.

The EAC’s macro-economic convergence criteria (thresholds) follow what their predecessors adopted to realise a monetary union. These unions are; the EU, SADC and the UEMOA. Their focal point of interest was price stability involving exchange rates stability, increasing the level of external reserves, setting fiscal constraints by limiting government debt and deficits and encouraging coordination of economic policies amongst the member states. The only difference allowable of the criteria within different regions is the degree to which they allow member states to vary and adjust for economic shocks (Kuteesa, 2012).

The criteria adopted by the monetary committee are indeed the thresholds that member states have to attain before joining the intended monetary union. The process of achieving these thresholds is expected to affect the economic performance of the member countries either positively or negatively; for example, governments will be required to have low inflation, increase their savings to GDP ratio, reduce their budget deficit, and increase their foreign reserves. These are fundamental variables that indeed do affect economies either upwards or downwards, depending on how they are implemented. It is noteworthy, that most of the members of the EAC were operating way below the thresholds when they were being adopted (Nannyonjo & Asiimwe, 2014). However, some have improved, but the most common tendency is unprecedented fluctuations, making it challenging to predict sustainability. Nonetheless, if they are achieved, the member states are likely to benefit immensely in terms of stability and, more importantly, improved economic growth.

However, the significant questions of interest are the suitability of the stipulated thresholds to the actual scenario of the markets in the region. Did empirical findings support them, or they were just borrowed from other regional blocks? How suitable are they in the contexts of interest of the East African markets, which are mainly anchored in the rate of economic growth? Hence, the way forward in this regard would be to determine the actual optimum thresholds, supported by data from the East African region rather than wholesomely adopting and enforcing what other regional blocks have used, which may not be suitable or achievable for the region or even fail to contribute to economic growth as would be expected.

In looking at inflation; low and stable inflation leads to the improved wellbeing of the citizenry. For example, it promotes efficient use of productive resources by investors focusing on investment rather than on insulating themselves from the effects of high inflation. Low inflation promotes certainty in the expected returns on investments, unlike under high inflation, where investments may realise negative returns. Finally, individuals and businesses in low inflation are better able to make long term investments in a stable macroeconomic environment and generate positive economic growth than in uncertain environment where the inflation is high and unpredictable (Adusei, 2012).

The desirable level of fiscal deficit is a contestable subject where the classical economists favoured a balanced or a surplus budget (Hirsch, 2013). They argued that the economy would return to a natural state of equilibrium if left to operate independently. They argued further that government borrowing would crowd out private borrowing, the interest rates and capital structures will be manipulated, it will decrease
exports and ultimately lead to higher taxes, inflation, or both, thereby reducing productivity. On the other hand, after the 1920 depression, Keynesians advocated for a demand-driven economy whereby governments borrow money to increase spending as a targeted fiscal policy. Keynes championed countercyclical fiscal policies such that, in times of economic downturns, the government should undertake deficit spending to counter decreasing of investments that would catapult consumer spending and stabilize aggregate demand and growth (Nkrumah, 2016). However, for an everyday operational basis among regional member states, they are encouraged to adopt low fiscal deficits; hence, the economic communities such as the EAC set its maximum threshold.

Lastly, high external reserves are desirable because they give the central bank room to combat depreciation in a nation’s currency. When a nation’s currency begins to depreciate, the central bank can sell its reserves and buy local currencies to stop the depreciation of the local currency. The external reserves are usually measured in months of import to capture the number of times the reserves can sustain imports in case of a shock. Hence having a high reserve is usually more desirable, but it is crucial to have a limit so that there is less overholding of reserves that could have been used in investments (Ajibola et al., 2015). Reserves are an essential economic component for the government and even the private investors in the use for external payments for imports, including capital imports that directly contribute to increased economic growth.

III. STATEMENT OF THE PROBLEM

The East African Community was re-established to fast track the objectives and visions of the regional cooperation. They then settled on a road map: forming a customs union, followed by a common market and ultimately expected monetary union. To form the monetary union, they set out minimum criteria/thresholds that have to be met by member countries before they can join the MU. However, these thresholds could have been merely adopted out of borrowing best practices or benchmarking from other regional unions that have established monetary unions. The inherent problem in this case is that the member states of the EAC have been unable to achieve the desired threshold levels. This situation, therefore, brings the hitherto questions; how suitable are these thresholds given the prevailing situations in the region. The thresholds ought to be based on the structure of actual data collected from the region and analysed to test their optimality, especially concerning the overall targeted goal of more significant GDP growth and eventual economic development. In a nutshell, we can say there is no empirical literature that has sorted to establish the suitability of these thresholds to the obtaining market situation of the region.

Therefore, the objective of this study is to establish the optimal/actual thresholds supported by empirical data to enable upholding, appraising, or otherwise advising on the thresholds that the EAMC adopted. The advice will guide the East African countries’ governments on the practicality of the targets that have been put to them as a requisite condition that they have to meet before joining the EAC monetary union. These thresholds might be too stringent that they may not be practical for the members to attain, or they could be too lenient, leading to a MU that may not benefit the member states. On the overall, the thresholds may also be retrogressive, therefore hampering economic growth.

A. Research Objective

The overall objective is to establish how the thresholds set by the EAC have affected the economic growth in the region.

The specific objectives of this study are as follows:

a) To determine the optimal thresholds of inflation, budget deficits and external reserves within the EAC
b) To determine how the optimal thresholds compare with the thresholds stipulated by the East African Monetary Committee
c) To determine the impact of the thresholds to the GDP growth rates within the EAC

B. Research Questions

1) What are the optimal thresholds for inflation, budget deficit and external reserves within the EAC?
2) How do the optimal thresholds compare to those set by the East African Monetary Committee?
3) How do the thresholds relate to the GDP growth rates within the EAC?
IV. SIGNIFICANCE OF THE STUDY

The EAC was formed with the ultimate objective of forming a monetary union (MU). A MU has many benefits to the countries that adopt it, resulting in the elimination of currency exchange costs, reduction in exchange risks within the member states, stability of prices, employment, and ultimately more significant GDP growth. The region would ultimately have supra-national central banks where individual countries will give up their sovereignty to adjust monetary policies allowing the market to operate based on market mechanism and partially through the controls of fiscal policies.

Ordinarily, countries intending to join a MU have to meet the optimum currency area criteria, anchored on an efficient adjustment mechanism, based on open market dynamics where the market equilibrium is self-restoring for countries faced with shocks and bring about harmony in the entire region (union). These countries must exhibit convergence in significant macro-economic policies where they must have similar levels of economic development, the tendency of inflation, economic structures, budget deficits, and legal systems. Therefore, regional blocks set thresholds that members must meet before joining the monetary union to achieve all that.

Therefore, it is vital to assess how these thresholds have changed the region's economic performance since they were set by the EACMAC as the bare minimum for the East African countries to meet before forming the MU. The interest thresholds are the budget deficit, inflation, and external reserves. The targets set by the committee were indeed based on best practices borrowed from other regional economic blocks. However, this paper seeks to establish the optimal levels given by the MAC based on actual data from the member states. The optimal levels are then compared with the adopted levels to give an opinion of the way forward for the EAC Monetary Union. The outcomes of this study will therefore help policymakers of member countries to reconsider or maintain their trajectories towards achieving the targeted thresholds.

V. LITERATURE REVIEW

A. Theoretical Literature

1) The Traditional OCA Theory

The threshold effect of macro-economic convergence criteria on real GDP growth is a study mostly pegged on the Optimum Currency Areas (OCA) theory, which lays out the preconditions to forming a monetary union. The preconditions of the theory are; real wage flexibility, labour mobility, and integration of fiscal policies. In Figure 2 below, the vertical axis captures real divergence between countries that want to be members of a MU. Asymmetric shocks bring about real divergence amongst the neighbouring countries or symmetrical shocks handled using different policies occasioned by different economic structures. On the horizontal axis, the degree of flexibility in the labour market for the region is presented, indicating the degree of interregional mobility of labour and the flexibility of the real wage.

The OCA theory postulates that countries with high divergence in GDP and employment trends will require a highly flexible labour market for them to be able to join a MU and avoid the problem of making significant adjustments. When the degree of real divergence is high, the labour market needs to be more flexible for the monetary union to function smoothly. The theory is explainable using the Figure 2 below:

![Fig. 2. The theory of optimum currency areas (Grauwe, 1996).](image-url)
The upward-sloping line AA depicts the relationship between real divergence and flexibility. Nations that fall above this line need to adjust to join a MU, unlike countries below it. The countries below the line AA form the optimum currency area (OCA), and they do not need to incur many adjustment costs to join a monetary union. Countries above the line have a lesser degree of flexibility in their labour market, and for them to join a MU they need to have a flexible exchange rate. The theory envisions those countries that are not flexible enough and decide to form a MU will face macroeconomic management difficulties. There will be a tussle on the appropriate macroeconomic policies the union central bank should undertake if some member states face asymmetric shocks. There is the risk that if there is a need for expansionary intervention, the unaffected countries may choose to act differently, leading to the failure of the MU (Grauwe, 1996).

According to OCA theory, countries with different economic growth rates and institutional factors need to achieve real convergence. The convergence is a process of in-depth structural and institutional changes within the countries, resulting in more synchronised economies towards development and their functioning mechanisms. These led to the emergence of convergence criteria that countries intending to join a MU must fulfil. The criteria were first used during the European Union Treaty, commonly referred to as the Maastricht Treaty. In a nutshell, it laid out that the countries must achieve the following stabilization criteria; fiscal, price, long-term interest rates and national currency exchange rates (Bukoswski, 2006).

B. Empirical Literature

1) Inflation Threshold

Inflation threshold research by Lee and Wong (2005) investigated the existence of optimality by analysing the relationship between financial development and economic growth. The study used a threshold regression model to establish the appropriate threshold for inflation in Taiwan and Japan. The analysis established that financial development will promote economic growth with low and moderate inflation. They found that the inflation threshold that promotes financial development should be 7.25% in Taiwan and 9.66% in Japan. These thresholds were shown to have only occurred in the countries in the 1970s when a high inflation period coupled with an energy crisis was experienced in the two countries.

Elsewhere, Fabayo and Ajilore (2006) conducted a study to examine a relationship between inflation threshold and economic growth for Nigeria. They used data from 1970 to 2003 whereby they established that the appropriate threshold for inflation is at 6%. Below this level, data exhibits a positive and significant association between inflation and economic growth, and above this level, an increase in inflation leads to a decrease in economic growth. They conducted a sensitivity analysis to confirm these findings, and the overall conclusion was that the Nigerian government should ensure that they achieve single-digit inflation, whereby the optimal level is at 6%.

In Malaysia, another study was conducted to investigate the relationship between inflation and economic growth using data from 1970 to 2005 by Munir et al. (2009). The data was analysed using a threshold model developed by Hansen (2000). The study aimed to establish the appropriate threshold for the inflation rate in the country. The analysis found strong evidence that the relationship between inflation and economic growth is nonlinear. They established that the optimal inflation threshold is 3.89%, above which the economy's growth rate is significantly reduced, and below this level, the relationship between inflation and economic growth is positive. They concluded that the Malaysian government should take cognizant of the benefits of low inflation and formulate appropriate monetary policy having this in mind.

Adusei (2012) tried to establish whether the threshold effect will hold for South Africa using annual data running from 1965 to 2010 for inflation. The analysis used nonlinear regression models, and he found a threshold level of 7% for the inflation rate. Above this level, the effect of inflation on economic growth is negative and statistically significant. He concluded that the South African government should maintain inflation below 7% to realize economic growth.

Lastly, Tung and Thanh (2015) analysed the relationship between inflation and economic growth in Vietnam. The Vietnam economy was then characterised by a transition from a communist economy where variables were centrally planned to a market economy. The methodology used in the study encompassed Generalized Methods of Moments (GMM), Two-Stage Least Square (2-SLS), and Ordinary Least Square (OLS) methods to analyse the data running from 1986 to 2013. They found that the appropriate threshold for the nation is 7%, whereby any increase beyond this level, it would have adverse effects. They concluded that the policymakers needed to set targeted inflation of less than 7% to achieve stable economic growth.

2) Budget Deficit Threshold

Under the budget deficit threshold, Kabuga and Ahmed (2018) conducted a study to investigate the effect of budget deficits on the economic growth of Nigeria using data running from 1981 to 2014. The analysis used an autoregressive threshold model and established an optimal budget deficit level of 5% of
the GDP. They identified that the nation is characterised by a continuous fiscal deficit and pointed out that the government must maintain a fiscal deficit of not more than 5% of the GDP. The other variables in the model that had a positive and significant relationship to the GDP included; capital, labour, inflation rate, and trade openness.

Sierra Leone faced an increasing budget deficit before 2013; thus, the authorities instituted policies to remedy the situation. The immediate policy solution was to cut government spending, but they found the need to establish a sustainable budget deficit to formulate a reasonable budget suited to the prevailing economic conditions. These prompted Onwioduokit (2013) to conduct a study using a nonlinear Least Square approach on the appropriate threshold for budget deficit for Sierra Leone. He established that the appropriate threshold was 7% of the GDP, and if this were exceeded, it would be of adverse effect on economic growth. He concluded that Sierra Leone should purposefully formulate policies that would lead to budget deficits lower than 7% of the total GDP in a given year.

The same kind of study was conducted in Pakistan whereby Kanwal et al. (2017) targeted to establish the relationship between fiscal deficit and economic growth and further check for the presence of a threshold within which economic growth would be optimal. This study was conducted using data running from 1972 to 2014. The idea was to check for a threshold that would help the policymakers benchmark to use fiscal expansion to enhance economic growth. They used a smooth transition autoregressive model on time series data. They established a 5.57% of GDP threshold; if this was exceeded, the effect of the deficit was negative on the GDP. They concluded that fiscal policy that would maintain the budget deficit below the threshold would spur economic growth as long as public spending is channelled into productive investments that would promote long-term growth objectives.

Nkurumah et al. (2016) conducted a study to establish the relationship between Ghana’s budget deficit and economic growth from 2000 to 2015 using quarterly data. The analysis used the Autoregressive Distributive Lag (ARDL) model that included a trend analysis. Their findings were that from 2000 when there was a high budget deficit, the following year would realize low economic growth and vice versa. The overall finding was that a high budget deficit negatively affects economic growth. They found that a 100% increase in the budget deficit leads to a 3% decrease in the rate of economic growth. They concluded that a high budget deficit does not translate to high economic growth, and therefore, the government should uphold a high level of fiscal discipline to protect its citizens from the deleterious effects of high debt, especially for future generations.

3) External Reserves Threshold

There have been several types of research in this area. In 2016, Nwachukwu et al. analysed the long-run relationship between the external reserves and the exchange rates in Nigeria. They used the Threshold Vector Error Correction Model (TVECM) framework to establish the appropriate threshold for external reserves using daily data from 2014 to 2015. Modelling was done using Bureau De Change (BDC) exchange rates and external reserves, which are oversighted by the Nigerian central bank. They found a nonlinear long-run relationship between the series, which supported the choice of TVECM. Above the established threshold, the two series exhibit cointegration. The outcome exhibited two regimes; the usual accounting for 93.1% and the unusual one accounting for 6.9% of the observations. They also found that the error correction coefficient was not statistically significant at 5% for the first regime but significant at 10% for the second regime. They concluded that the adjustment mechanism between the two variables flows from external reserves to the BDC exchange rate.

In another research, Ajobola et al. (2015) also estimated the long-run relationship between the external reserves and exchange rate for Nigeria using quarterly data running from 1990Q1 to 2012Q4. They found evidence for threshold cointegration between the variables rather than linear cointegration. As a result, they used the maximum likelihood procedure, which estimated a two-regime TVECM. The analysis demonstrated that cointegration between the two variables only occurs when the equilibrium errors exceed the estimated threshold of 0.52. Their finding was that the error correction coefficient for the two regimes is not significant showing that the exchange rates are not responding to the equilibrium error in the analysis period. However, they found that external reserves adjust to correct divergence that happened in the past. This happens when the equilibrium error exceeds the threshold parameters. They concluded that external reserves would constantly adjust to maintain the long-run equilibrium error. The conclusion is in line with the monetary authority’s action to deploy external reserves to maintain the country’s exchange rate stability.

Chong et al. (2008) examined the relationship between the dynamics of foreign reserves and currency crises. They found that depletion of foreign reserves rapidly leads to the collapse of the exchange rates systems. They used the autoregressive threshold model and found that when the ratio of reserves to external debts falls to more than 29.1% and the reserves to M2 drop to more than 24.3% within six months, the country is likely to face an exchange rate crisis. They concluded that the model they used
provides a warning mechanism for policymakers to take measures to prevent the reserves from decreasing to critical levels.

In another study, Law et al. (2019) tested the threshold effect of the degree of financial integration on the relationship between monetary independence and external reserves. They used linear threshold models and compared them using cross-sectional data collected from 55 developed and developing countries from 2012 to 2014. The analysis showed that the foreign exchange reserves have to be maintained above a certain threshold for the economies to realize monetary independence. The conclusion was that external reserves also must be maintained above some threshold if the countries have to attain monetary independence and financial integration.

The empirical literature reviews have demonstrated that most of the studies involving the test of thresholds have concentrated on specific variables of interest: budget deficit on economic growth, inflation on economic growth, and foreign reserves on economic growth. None of these studies have tried to determine the effect of thresholds set by monetary unions on the economic growth of member countries. In response to the findings, this paper expands to counterechecking the optimal levels vis-a-vis the thresholds that have been preset by the EAC Monetary Affairs Committee using the latest data available. This analysis also narrows down to the EAC, because there is a will to form a monetary union, but there has been no prior study on how the preset thresholds have affected growth in the region.

VI. METHODOLOGY

A. Theoretical Methodology

The methodology used in this paper is anchored on the Theory of Optimum Currency Area (OCA) and the Maastricht Treaty; countries have to meet some minimum conditions (thresholds) for a stable monetary union to be established. In an optimum currency area, the countries relinquish their sovereign ability to adjust monetary instruments to a supra-national central bank of the region. The conditions to join these monetary unions should be negotiated given the neighbouring countries’ specific conditions.

Traditionally, these countries will form convergence criteria through an agreed position of their combined monetary committees, where they set up benchmarks that member countries have to adhere to or meet before onboarding to the MU. The regional monetary committees outline these criteria then the neighboring countries that want to join the union works towards attaining them. The criteria are referred to as thresholds that members of MU should meet.

Once a MU is formed, the supra-central bank takes over monetary policies, and when the countries face asymmetric shocks, they have to take measures to stabilize the macroeconomic conditions in the region. It is crucial that nations seeking to join a monetary union first attain some degree of similarity in macroeconomic stance and fiscal structures so that then countries do not disagree when it comes to taking measures that involve fiscal measures of significant magnitude to salvage a member faced with adverse economic shock (De Grauwe, 2006)

B. Empirical Methodology

The thresholds for the budget deficit, inflation, and external reserves in this analysis is analyzed using a dynamic threshold panel model which can be presented as:

\[ y_{it} = \begin{cases}  u_t + \beta'_1 x_{it} + e_{it}, & q_{it} \leq \gamma \\ u_t + \beta'_2 x_{it} + e_{it}, & q_{it} > \gamma \end{cases} \quad (1) \]

The panel has to be balanced where \( \{y_{it}, q_{it}, x_{it}; 1 \leq i \leq n, 1 \leq t \leq T\} \). The \( i \) represents individual changes and \( t \) is the changes that occur over time. The dependent variable is \( y_{it} \), the threshold is given by \( q_{it} \), and the other control variables are given by \( x_{it} \) which may have \( k \) vectors. In this model, there exists more than one regime that depends on whether the threshold is bigger or smaller than the threshold \( \gamma \). The two regimes have different regression slopes \( \beta'_1 \) and \( \beta'_2 \). The model assumes that; \( x_{it} \) is time-invariant for consistent estimation of \( \beta'_1 \) and \( \beta'_2 \), the threshold variable \( q_{it} \) is also time-invariant and the error term is independently and identically distributed (iid) having a zero mean and finite variance \( \delta^2 \). The assumption of iid ensures that the dependent variables do not have lags from \( x_{it} \) (Hansen, 2011).

The advantage of using a dynamic threshold model compared to a static/traditional threshold model is that above establishing the possibility of the existence of a threshold, it also deals with potential endogeneity in the data because it uses the Generalized Method of Moments (GMM) model. The procedure uses a tool which is a variable matrix that is orthogonal to the random perturbation term which is constructed to ensure that the variable matrix tool is not related to the random perturbation term. In this model, a grid search algorithm is used to determine the threshold value which ensures the endogenous grouping requirement is met solving the problem of endogeneity within the variables (Ran et al. 2020).
C. Source of Data

Data used in this study was extracted from the World Bank website under the subcategory World Development Indicators running from the year 2005 to 2020. Table II below describes the variables of interest.

| Variable                      | Data Description                                                                 | Source                     |
|-------------------------------|----------------------------------------------------------------------------------|----------------------------|
| Gross National product in USD | The GDP for the East African countries is expressed in USD for the years of study | World Bank data indicator  |
| Total foreign exchange reserves | The total foreign exchange reserves are expressed in USD for the East African countries | World Bank data indicator  |
| Gross domestic savings        | The total savings in each country is expressed in USD for the entire period. The total savings will be used as a proxy for investment for the East African Countries. "The percentage change in Consumer Price Index (CPI) on a year-on-year basis."   | World Bank data indicator  |
| Inflation                     | Government expenditure is expressed in USD for all countries in the EAC          | World Bank data indicator  |
| Government Expenditure        | The net Export is calculated in USD for all the East African countries          | World Bank data indicator  |
| Debt financing                | Year on year total debt of the government is peroxided by the level of short-term debt of the nation. | World Bank data indicator  |

VII. DATA ANALYSIS AND PRESENTATION

A. Descriptive Statistics

| Variable                      | Description                                                                 | Mean | Std. Dev. | Min | Max | Observations |
|-------------------------------|-----------------------------------------------------------------------------|------|-----------|-----|-----|--------------|
| Id                            | The id in this panel data is the East African countries arrange alphabetically | 3.000| 1.423     | 1   | 5   | N = 80       |
|                               | overall                                                                       |      |           |     |     |              |
|                               | between                                                                      | 1.581| 1         | 5   | n = 5|              |
|                               | within                                                                       | 0.000| 3         | 3   | T = 16|              |
| year                          | The data in this analysis runs from 2005 to 2020                              | 2012.500| 4.639 | 2005| 2020| N = 80       |
|                               | overall                                                                       |      |           |     |     |              |
|                               | between                                                                      | 0.000| 2012.5 | 2012.5 | n = 5|
|                               | within                                                                       | 4.639| 2005    | 2020 | T = 16|              |
| GDP                           | Gross domestic product in a trillion                                         | 26.307| 24.181 | 1.12 | 98.840| N = 80       |
|                               | overall                                                                       |      |           |     |     |              |
|                               | between                                                                      | 22.436| 2.34    | 55.791| n = 5|
|                               | within                                                                       | 13.302| -10.744 | 69.356| T = 16|
| consumption                   | Household consumption in a trillion                                          | 19.261| 18.706 | 1.010 | 86.180| N = 80       |
|                               | overall                                                                       |      |           |     |     |              |
|                               | between                                                                      | 17.123| 1.918   | 44.809| n = 5|
|                               | within                                                                       | 10.601| -11.418 | 60.632| T = 16|
| savings                       | National savings in a trillion                                               | 5.006| 4.986    | 0.660 | 22.270| N = 80       |
|                               | overall                                                                       |      |           |     |     |              |
|                               | between                                                                      | 4.676| 0.866   | 12.611| n = 5|
|                               | within                                                                       | 2.674| -2.116  | 14.665| T = 16|
| govt_exp                      | Government expenditure in a trillion                                         | 3.106| 2.965    | 0.160 | 13.140| N = 80       |
|                               | overall                                                                       |      |           |     |     |              |
|                               | between                                                                      | 2.875| 0.559   | 7.691 | n = 5|
|                               | within                                                                       | 1.447| -1.324  | 8.556 | T = 16|
| netexpt                       | Net export in a trillion                                                     | 7.531| 2.404    | 0.960 | 9.750 | N = 80       |
|                               | overall                                                                       |      |           |     |     |              |
|                               | between                                                                      | 2.213| 3.806   | 9.461 | n = 5|
|                               | within                                                                       | 1.345| 4.684   | 12.324| T = 16|
| ext_debt                      | External debt in trillion                                                    | 0.820| 0.943    | 0.000 | 3.150 | N = 80       |
|                               | overall                                                                       |      |           |     |     |              |
|                               | between                                                                      | 0.897| 0.014   | 1.876 | n = 5|
|                               | within                                                                       | 0.488| -0.392  | 2.094 | T = 16|
| res_months                    | Total reserves in months of import                                           | 4.313| 1.386    | 0.130 | 7.210 | N = 80       |
|                               | overall                                                                       |      |           |     |     |              |
|                               | between                                                                      | 0.737| 3.353   | 5.203 | n = 5|
|                               | within                                                                       | 1.217| 1.090   | 8.170 | T = 16|
| inflation                     | Inflation based on GDP deflator                                              | 10.095| 4.956   | 0.150 | 27.220| N = 80       |
|                               | overall                                                                       |      |           |     |     |              |
|                               | between                                                                      | 1.774| 8.018   | 12.545| n = 5|
|                               | within                                                                       | 4.692| -2.300  | 24.770| T = 16|

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Descriptive statistics for panel data is conducted to get basic information of the data that is going to be used in the analysis. This analysis enables the analyst to tell whether the variables are varying across time and individuals. Table III below shows that all the variables are varying across time and within individuals; of interest, will be to examine the dispersion of the data by taking note of the standard deviation between and within individual variables. The threshold variables of interest for the analysis are; budget deficit – where external debt was used as a proxy as data for some of the countries were not available, inflation and total reserves in months of import. The control variables in the analysis will be; investments- where savings were used as its proxy, government expenditure, consumption, and net exports.

A. Empirical Results

The empirical analysis is conducted using dynamic panel data and a dynamic panel threshold model to test for the presence of a threshold. A bootstrap-based Wald test confirms the presence of a threshold effect. Under this analysis, the null hypothesis is that there is no threshold effect in the various macro-economic variables that the East African Monetary Committee selected. The testable variables outlined are; inflation, budget deficit, and external reserves. The analysis is conducted in three faces where each of the variables is analysed independently

1) The Threshold for Inflation within the EAC

The inflation threshold that the East African Monetary Committee set that members need to observe before adopting a MU is less than 5% annually. Evidence from the data obtained shows that there is only one threshold, and the Wald statistics P-value is significant at 1% and hence the dynamic threshold model rejects its original hypothesis that there is no threshold.

The threshold values for inflation are shown in Table IV below. The test for the presence of the second and third thresholds is not statistically significant. The threshold value is 7.5%, which is relatively higher than the East African Monetary Committee's target. Therefore, the evidence shows that East African countries are not adhering to the monetary committee's prescribed criterion. The finding is further confirmed by Wald statistics' value, which is higher than all the critical values at 10%, 5%, and 1%, as can be seen in the table.

| Threshold Parameter | Threshold value | P-value | BS | Confidence interval | Wald statistics | Critical values 10% | Critical values 5% | Critical values 1% |
|---------------------|----------------|---------|----|---------------------|-----------------|----------------------|--------------------|--------------------|
| Inflation 1         | 7.54           | 0.005   | 1000 | 7.125               | 7.72            | 22.27                | 8.3726             | 11.8325            | 16.9772            |
| Inflation 2         | 5.98           | 0.4290  | 1000 | 5.85                | 8.11            | 2.73                 | 7.1747             | 8.7691             | 11.5422            |
| Inflation 3         | 12.24          | 0.6150  | 1000 | 12.43               | 13.02           | 2.99                 | 16.6944            | 25.8417            | 241.6474           |

Source: Authors computation.
In Table V above, the regression results in model 1 show that inflation has a significant threshold effect on the GDP in the East African countries when inflation is used as a threshold variable. The effect of inflation is significantly positive (0.233) when inflation is less than 7.5. The estimated inflation coefficient decreases to 0.0359, which is insignificant when inflation is above the 7.5% thresholds. Therefore, we can deduce that inflation is significant and increases the GDP growth at low levels than 7.5%. The level that the East African monetary committee adopted at 5% is optimal, ensuring that the East African countries’ GDP will grow. Note that the second model and third are not significant; hence there is no need to interpret them.

2) The Threshold for Budget Deficit within the EAC

The East African Monetary Committee's budget deficit to GDP ratio threshold, which EAC members need to observe so that the monetary union can be adopted, must have been less than 6% by 2010 and less than 5% by the end of 2014. Data for the budget deficit was not available, and the analysis used External Debt as a proxy to approximate the optimal amount of debt for the nations. Analysis of the data obtained shows that there is the presence of only one threshold, and the Wald statistics P-value is significant at 5%, and hence the dynamic threshold model rejects its original hypothesis that there is no threshold.

The threshold values for external debts are shown in Table VI. The presence of the threshold in the second and third thresholds tests is not statistically significant. The threshold value is 1.62; the data are in trillions, and taking its ratio to that of the average GDP over the study period, the value is 6.16% which is slightly higher than the stipulated range by the East African Monetary Committee.

This analysis shows that the countries in East Africa are borrowing above the level that the East Africa Monetary Committee has recommended to help the region realize a monetary union. The data extended to six years after the target date, yet the threshold is still not met. Therefore, the members need to establish ways to be more self-reliant. The finding is further confirmed by the value of the Wald statistics which is higher than the critical values at 10%, and 5%.

### Table VI: The Threshold Values for the Budget Deficit

| Threshold Parameter | Threshold value | P-value | Confidence interval | Wald statistics | Critical values |
|---------------------|----------------|---------|---------------------|-----------------|-----------------|
| Ext_debt 1          | 1.62           | 0.036   | 1000                | 0 0 15.44       | 5.069 13.6971   |
| Ext_debt 2          | 0.97           | 0.400   | 1000                | 0.96 1.57       | 6.0284 7.7769   |
| Ext_debt 3          | 1              | 0.544   | 1000                | 0.97 0.89       | 3.6136 5.1659   |

Source: Authors computation.

### Table VII: Budget Deficit Threshold Regression

| Variable            | Model 4         | Model 5         | Model 6         |
|---------------------|-----------------|-----------------|-----------------|
| Consumption         | 0.9186***       | 0.9265***       | 0.9273***       |
| (0.0219)            | (0.0228)        | (0.0229)        |                 |
| Investment          | 1.0961***       | 1.0876***       | 1.0879***       |
| (0.0259)            | (0.0269)        | (0.0271)        |                 |
| Government          | 1.0778***       | 1.0713***       | 1.0667****      |
| (0.1526)            | (0.1590)        | (0.1603)        |                 |
| Net export          | -0.1529***      | -0.1238         | -0.1155*        |
| (0.0612)            | (0.0659)        | (0.0686)        |                 |
| External debt ≤ λ  | 0.0160          | 0.0262          | 0.0262          |
| (0.0290)            | (0.0369)        |                 |                 |
| External debt ≥ λ  | 0.1473***       | 0.1578****      | 0.1601***       |
| (0.0290)            | (0.0389)        | (0.0395)        |                 |
| External debt ≤ λ  | 0.0401          |                 |                 |
| (0.0570)            |                 |                 |                 |
| External debt ≥ λ  | 0.1601***       |                 |                 |
| (0.0395)            |                 |                 |                 |
| Cons                | 0.7441          | 0.4461          | 0.3824          |
| (0.464)             | (0.464)         |                 |                 |
| Wald test           | 12044.25***     | 9650.67***      | 8347.43***      |

N 80 80 80

Note: ***, **, and * indicate the significance at 1%, 5%, and 10% levels, respectively. Figures () are the standard errors.

Source: Authors computation.
In Table VII above, the regression results in model 4 show that external debt has a significant threshold effect on the East African countries’ GDP when external debt is used as a threshold variable. The effect of external debt is not significant when it is less than 1.62 trillion. The estimated coefficient of external debt increases to 0.15, which is significant at 1% when external debt is above the 1.62 trillion thresholds. The analysis suggests that there is no harm when the member states borrow above the stipulated threshold because when the debt is low, the countries are likely to realize slower economic growth than when the debt/budget deficit is below 6.16%. Therefore, the East African Monetary Committee should consider increasing the desired debt to GDP ratio (at least to 6.5%), which is greater than the level recommended in the convergence criteria. Note that the second and third tests are not significant; hence there is no need to interpret them.

3) The Threshold for External Reserves within the EAC

The total reserve in months of import threshold set by the East African Monetary Committee for members to be allowed to the monetary union should be sufficient for more than (greater than) 6 months by 2014. Analysis of the data obtained shows that there is the presence of only one threshold, and the Wald statistics P-value is significant at 10% for the first threshold and 1% for the second threshold. Hence the dynamic threshold model rejects its original hypothesis that there is no threshold.

The threshold values for reserves in months are shown in Table VIII. The third threshold is not significant; therefore, we will focus on the values of the first and the second thresholds that the East African countries must operate at; the threshold value, which is roughly 4 months for the first threshold and 5 months for the second threshold slightly below the level that the East African Monetary Committee set. They had set that the members needed to have realized greater than 6 months of reserves on imports by 2014 and using the data running from 2005 to 2020 the threshold is at 5 months, the community ought to have realized greater than 4 months in reserves on imports by 2010 and greater than 6 months in reserves on imports by 2014. The finding is further confirmed by the values of the Wald statistics which are higher than the critical values at 10%, 5%, and 1%.

### Table VIII: The Threshold Values for External Reserves

| Threshold Parameter | Threshold value | P-value | B | Confidence interval Lower | Confidence interval Higher | Wald statistics | Critical values 10% | Critical values 5% | Critical values 1% |
|---------------------|----------------|---------|---|---------------------------|---------------------------|-----------------|---------------------|---------------------|---------------------|
| Inflation 1         | 4.01           | 0.083   | 1000 | 3.84                     | 4.03                     | 12.09           | 10.335              | 9.0986              | 7.6762              |
| Inflation 2         | 4.86           | 0.000   | 1000 | 4.82                     | 4.94                     | 80.54           | 63.696              | 58.602              | 53.505              |
| Inflation 3         | 3.93           | 0.088   | 1000 | 3.8                     | 3.97                     | 11.46           | 10.592              | 9.0986              | 7.6762              |

Source: Authors computation.

### Table IX: External Reserves Threshold Regression

| Variable              | Model 7 | Model 8 | Model 9 |
|-----------------------|---------|---------|---------|
| Consumption           | 0.9067***| 0.9465***| 0.9282***|
| Investment            | 1.1223***| 1.0696***| 1.1050***|
| Government Expenditure| 1.1314***| 1.1166***| 1.0517***|
| Net export            | -0.2330***| -0.1167*| -0.1747***|
| Reserve in months ≤ λ | -0.0277 | (0.0370) |         |
| Reserve in months ≥ λ | 0.1190***| (0.0311) |         |
| Reserve in months ≤ λ | -0.4179***| (0.1021) |         |
| Reserve in months ≥ λ | 0.0264 | (0.0345) |         |
| Reserve in months ≤ λ | -0.2433**| (0.0981) |         |
| Reserve in months ≥ λ | 0.0409 | (0.0307) |         |
| Cons                  | 1.3293 | 0.1171 | 0.8636 |
| Wald test             | 0.6383***| 11207.23***| 12589.58***|

Note: ***, **, and * indicate the significance at 1%, 5%, and 10% levels, respectively. Figures () are the standard errors.

Source: Authors computation.
From Table IX above, the regression results in model 7 show that reserves in months have a negative (-0.028) significant threshold effect on the GDP within the East African Countries when reserve in months of imports is less than 4 months reserve on imports (which is the threshold). The effect of external reserves in months of imports coefficient is positively significant (0.12) at 1% when the values are more significant than 4 months. In model 8, (the second threshold) is significant, but coefficients of the threshold are inconclusive, and hence we will base our discussion on the regression in model 7.

Therefore, the reserves in months of imports are more significant than 4 months which is precisely the recommended threshold that the East African Monetary Committee had put as the target that the member countries must realize by 2010, which was achieved. However, on the other hand, since our data runs from 2005 to 2020, the threshold does not meet the desired level of more than 6 months for months of import. Thus, more efforts should be put in place to meet the threshold.

VIII. CONCLUSIONS AND RECOMMENDATIONS

The conclusions from findings of the previous section will be discussed in this section, and recommendations be drawn thereafter.

A. Summary of Findings

The optimal thresholds established for inflation, budget deficit, and external reserves are 7.5%, 6%, and imports for 4 months. These levels are compared to the thresholds set out by the East African Monetary Committee of 5%, 5%, and imports for 6 months, respectively.

B. Conclusions

The optimal threshold for inflation from the data is slightly higher at 7.5% than the target rate of less than 5% set by the East African Monetary Committee. This finding is similar to Adusei (2012) study, which established a threshold of 7%. He recommended that the inflation level for South Africa at that time was optimal up to that level and should be held below that threshold. A low level of inflation is essential for economic growth, and the recommended rate of inflation by the committee is within the threshold that generates positive changes in the rate of economic growth. Hence the conclusion is that this threshold of 5% will lead to more growth, although the evidence suggests that the EAC member states have room to increase their inflation levels by a margin of up to 2.5% more to realize more economic growth.

The East African Monetary Committee recommends that the budget deficit to GDP ratio be at least 5% by 2014. Six years later, the threshold for debt to GDP ratio alone without including internal borrowing and grants is at 6%. The optimal threshold obtained is similar to the one established by Kawal et al. (2017); they established a threshold of 5.57% that the Pakistan government should not exceed the budget deficit. This evidence suggests that the appetite for deficit financing among the EAC member states is way above the desired level to propel the region to realize a monetary union. According to practice, countries would try to balance their borrowing not to spend so much of internally generated income in settling the loans and their interests in the foreseeable future. The analysis suggests that the EAC members are likely to realize less growth when the level of borrowing is below the threshold of 6%, and after that, the effect is enormously significant at 1%, and as members continue to borrow, they will realize more growth up to the optimal of 6.5%. The analysis shows that the EAC members are heavily reliant on borrowing for their development.

The regression on months of imports threshold shows that the optimal threshold within the EAC is foreign reserves enough for 4 months of imports; the recommended level by the East African Monetary Committee is that member states must realize 6 months in reserves for imports for the region to adopt a monetary union. Reviewed empirical literature mostly used in their analysis what reserves can purchase rather than months of imports reserves can be used. Ajibola et al. (2015) used cointegration and found that optimality is when the reserves to GDP ratio is above 0.52%, but in our case, when this level is below 4 months of imports, which is the threshold, the effect of reserves is not significant, but when it is above this threshold it is significant at 1%. Therefore, the recommended threshold of 6 months is within the range of generating positive GDP growth. As members continuously increase their reserves in months higher than the threshold of 4 months, they will realize increasing GDP growth. Data suggests that the member states are slightly below the recommended target of 6 months, which calls for more policies and measures to enable the member states to realize that level to be able to form a monetary union.

C. Recommendations

The inflation rate that was recommended by the East African Monetary Committee is in the optimal region but evidence suggest that it is so stringent and that member countries should be allowed some margin of 2.5% to have a latitude of whether to increase their inflation rate or not. Theory postulates that
low levels of inflation are good for economic growth and the EAC members must continue to maintain low levels of inflation. However, some degree of inflation would also promote export as the goods produced in a country will become less expensive compared to those produced in other countries because the local currency will also be inexpensive relative to the foreign currencies.

The threshold test for the budget deficit represented by external borrowing shows that growth within the EAC is heavily reliant on external borrowing such that low levels of borrowing below the threshold is not significant but debt above the threshold is positive and strongly significant. This is not a positive aspect of these economies and more measures must be put in place to enable the economies to be more self-reliant. The injection of external debt into the economy may paint a picture of an expanding economy in the short-run but the long run implication of debt repayment including interest may strain these economies to the extent that they will not achieve meaningful growth. This is an area that needs further understanding because the data that is available do not have actual statistics on the budget deficit for the countries in the East African region and that is why in the analysis we opted to use a proxy of debt.

Regression results of reserves in months of imports indicate that the optimal threshold is 4 months compared to the 6 months recommended by the monetary committee. These show that the EAC members are operating way below the desired level. It is straightforward that more reserves is desirable such that in case of a shock these nations are able to finance their imports and cushion their currencies from adverse effects. Therefore, more needs to be done within the community that will promote production such that the countries will have more exports than imports to enable them generate more reserves than it is evident from the available data. It would be fascinating for future inquiry to establish mechanisms that can be put in place to promote more production in the region and reduce over reliance on imports.

CONFLICT OF INTEREST

I hereby declare that there is absolutely no conflict of interest as far as this paper is concerned.

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