TRANSMISSION MECHANISMS AND MACROECONOMIC CONVERGENCE WITHIN THE EAST AFRICAN COMMUNITY

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DECLARATION

I, hereby, certify that the thesis submitted here is my authentic work and has never before been proffered for a degree at any other university.

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DEDICATION

This treatise is a dedication to my mother, wife Rinah, daughter Mercy, son Dismas, son Francis, and late father, all who always encouraged me and believed in my academic future.

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LIST OF ABBREVIATIONS/ACRONYMS

ADF: Augmented Dickey-Fuller

CET :   Common Eternal Tarif

CFA :   Communaute Financiere d'Afrique

CMA: Common Monetary Area

CMP: Common Market Protocol

CM: Common Market

COMESA: Common Market for Eastern and Southern Africa

CPI: Consumer Price Index

CSSS: Community of Sahel-Saharan States

DFI: Direct Foreign Investment

EAC: East African Community

EAMC: East African Monetary Committee

ECCAS: Economic Community of Central African States

ECGL: Economic Community of the Great Lakes countries

ECM: Error Correction Model

ECOWAS: Economic Community of West African States

EMU: European Monetary Union

FEM: Fixed-Effect Model

GARCH: Generalized Autoregressive Conditional Heteroscedasticity

GDP: Gross Domestic Product

GPPP: Generalized Purchasing Power Parity

GVAR: Global Vector Autoregressive

IFS: International Financial Statistics

M2:   Nominal Quantity of Money

MPTC: Monetary Policy Transmission Channels

MTM: Monetary Transmission Mechanisms

MP: Monetary Policy

MU: Monetary Union

NEG: Neoclassical Exogenous Growth models

NTBs: Non-Tariff Barriers

OAU: Organization of African Union

OCA: Optimal Currency Area

OLS: Ordinary Least Squares

OMO: Open Market Operations

RECs: Regional Economic Communities

SADC: Southern African Development Community

SVAR: Structural Vector Auto-Regression

UEMOA : Union Economique et Monétaire Ouest Africaine

VAR: Vector Auto-Regression model

VECM: Vector Error Correction model

UNECA: United Nations Economic Commission for Africa

WAEMU: West African Economic and Monetary Union

WAMA: West African Monetary Agency

WAMZ: West African Monetary Zone

WDI: World Development Indicators

ABSTRACT

The East African Community had set to achieve macroeconomic variables convergence by specific timelines to open way for the formation of a monetary union, which have never been realized even after numerous timelines. Member states continue experiencing slow Gross Domestic Product growth rates, persistent high inflationary and unemployment trends, and low intra-trade within the region due to high transaction costs, currency conversion risks and costs, and long bureaucratic payment procedures. These continue to negate the spirit inherent in the custom union and common market protocols that are already in place. Hence, the need to investigate the macroeconomic variables and establish their trends in comparison to the targets that had been set to realize the convergences and subsequent adoption of a monetary union.

The conceptualization of this thesis was anchored on three objectives. The first objective was to establish if the East African Community has been able to realize convergence in their macroeconomic policies as a prerequisite requirement for the inception of a regional currency union to stimulate economic growth. The second objective sought to establish if the monetary policy transmission channels used individually by the Partner States are converging to the extent that would lead to a conclusion that the monetary policies adopted in the region are geared towards the desired objective of forming the monetary union. The third objective assessed if the convergence criteria adopted by the Community are either backed by the real market data in the region or not.

Customs Unions, Common Markets, and Monetary Unions have proved beneficial in regional blocs where they have been well established. Hence, East African Community is not an exception in their determination to set up for the monetary union path. The economic union is beneficial in promoting trade, removal of currency conversion bottlenecks, making transaction costs significantly reduced, besides making payment procedures less bureaucratic. Therefore,

what was critical at this stage and of great interest was to measures the achievement levels of the convergences established by the Partner States; that is, by the joint East Africa Monetary Committee aimed at the realization of the intended goal of forming the monetary union.

Five East Africa member states were considered in the study, Kenya, Uganda, Tanzania, Rwanda, and Burundi. In answering the first objectives, the study employed panel data spanning the years 2008 to 2018 and adopted Sigma convergence, Beta convergence, stochastic convergence and Co-integration testing techniques. The results showed no evidence for macroeconomic convergence and that Rwanda, Uganda, and Burundi are not getting any closer to their counterparts Kenya and Tanzania whose economies are bigger. However, similar to what the convergence framework predicts, the macroeconomic variables are generally moving in the same direction, albeit in slow rate, which signifies good hope for long-term convergence, although not in the near future. Therefore, the East African Community must create strategies to ensure that the member states implement policy efforts that would drive the region towards mutual convergence to be able to achieve the monetary union goal.

The second objective aimed to test the stability of the East African monetary transmission mechanism channels of interest rates and exchange rates, and analysed the effect of interest rate and exchange rate on economic growth within the East African Community. Fixed effect, Unit-root test, Co-integration tests, and Sigma convergence tests were adopted in answering the second objective of the study. The finding showed stability in interest rates but volatility in exchange rates. The analysis also indicated the absence of convergence in the short-run for the exchange rates but the presence of convergence in interest rates. Nevertheless, there were indications of co-integration of the two variables of the monetary policy in the long run. This shows that the financial sector is doing well in the road map towards the formation of the monetary union. Interest rate was found to positively influence economic growth while exchange rate had a negative impact on growth. Thus, the East African Monetary Committee

should consider enforcing implementation of an exchange rate regime that can register sustained economic progress and achievement of the desired convergence.

For the third objective, the study adopted Dynamic Threshold analysis technique. The finding showed a slight variation between the thresholds supported by data and the set thresholds by the East African Monetary Committee. The set thresholds lie within close range of the market thresholds, but they are more stringent, such that there is room for flexibility that can be adopted to enable the region to realize its desired objective of a monetary union much faster.

The study recommended for the East African Monetary Committee to review its stance on the desired fiscal and monetary policies and the thresholds that member countries must attain for them to join the ultimate monetary union. There should also be a deliberate effort to review the fiscal and monetary policies instituted as the irreducible for the members to join the monetary union. For these to be achieved, there is need for strengthened unison, coordination and enforcement of regulations for the objective of a monetary union to be realized sooner.

Keywords:

Convergence, Transmission Mechanisms, Monetary Union, Sigma Convergence, Beta Convergence, Unit-root testing, and Co-integration

1.1 Background of the Study

After independence, African countries became passionate over the model of forming regional blocks not only to increase trade among themselves but also raise their bargaining power within the global arena. The regional blocks that have been established in Africa, hitherto, are the Economic Community of West African States (ECOWAS), the East African Community (EAC), the Common Market for Eastern and Southern Africa (COMESA), and the South African Development Community (SADC), (Onyango et. al., 2013). The overall goal of all the unions is to set up a full economic union in the end and eventually establish a political federation. The conceptual framework of this study was pegged on the successes witnessed since the formation of the European Monetary Union (EMU), which has a fully functional mutual currency at the moment, (Preis, 2019). The framework of the EMU was also equally anchored on the earlier success of the United States of America's Federal common currency.

Establishing a monetary union has its pros and cons. The pros include reduced costs of cross-border trade transactions; condensed and more stable exchange rates amongst the members; the opportunity to pool resources would enable the region to enjoy economies of scale, and; there will be wage and price stability, which brings about certainty in doing business. Conversely, a prime disadvantage of creating a shared currency is the impairment of member nations' vital power to flex their monetary policies when faced with both symmetric and asymmetric shocks such as drought, oil crises, global turndowns, and socio-economic turmoil, (Kigabo, 2018).[1]

In the EA region, an agreement to revamp a corporation triggered the formation of the East African Cooperation Tripartite Commission, which was endorsed in 1993 following an earlier

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[1] Examples here include the Russia-Ukraine, previously USA-Iraq crises, and even major catastrophes such as Tsunamis, and droughts among others.

failed attempt at integration. This led to the desire to further the integration agenda resulting in the formation of the East African Community (EAC) in 1999. Subsequently, the region agreed to form a Customs Union in the year 2004 followed by a Common Market Protocol (CMP) in the year 2009. Thereafter, the region agreed upon the establishment of a shared currency by the end of the year 2012. During the 11th 2013 Ordinary Summit, it was agreed that the push towards forming an East African Monetary Union (EAMU) be put into high gear, (Kabuga et. al., 2018).

At this point, it was conceptualized that the realization of the long-term objective of a sustainable Monetary Union (MU) required the EAC Partner States to achieve Macroeconomic Convergence[2]. For the union members to be deemed to have achieved MU level, macroeconomic convergences must be exhibited through convergences in Gross Domestic Product (GDP) growth rates, inflation rates, external reserves, and budgetary deficits as well as similarities in the Monetary Policy Transmission Channels (MPTC)[3] of interest rates and exchange rates at some set thresholds, (Kaboro, 2018). The Monetary Policy Transmission Mechanisms (MPTMS) of concern here are the interest rates and the exchange rates.

These have also been included as target macroeconomic variables by the East African Monetary Committee (EAMC). Empirical evidence mainly from studies that reviewed European Monetary Union (EMU) indicated that monetary coalescing is useful to regional blocks because it promotes efficiency and competitiveness in the financial markets. Consumers benefit directly from this through lower prices for financial services and indirectly through lower borrowing rates, (Kumo, 2011). Thus, it is important to determine the achievements made by the EAC, hitherto, concerning convergence in measures that affect the monetary policies that would translate to its benefits to the members from the full removal of rigid

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[2] Macroeconomic convergence refers to similarities in the level of corresponding macroeconomic variables of given countries or regions.

[3] Monetary Policy Transmission Channels (MPTC) and Monetary Policy Transmission Mechanisms (MPTMs) are used interchangeably to mean the same thing.

individual policies in the financial sector aimed at efficient market economies. The monetary policies are indeed aimed at promoting economic growth, which would also ultimately contribute significantly to the convergence of the other macro-economic variables.

Before the realization of monetary coalescing, regions are required to specify macroeconomic convergence criteria[4] that will direct member nations to realize the amalgamation. The EAC followed a similar track such that minimums and maximums were specified in directing macroeconomic approaches for the member nations, (Kuteesa, 2012). However, they have encountered some challenges emerging from the different institutional, social, and economic structures of the member countries.

The EAC established various committees chaired by the central bank administrators of the Partner States with the mandate to supervise, synchronize and align regional macroeconomic schemes geared towards achieving macroeconomic convergences. Other key duties were to include: standardization of the regional value-added tax, improving foreign exchange before the EAMU, introducing current and embedded payment and settlement procedures, and harmonization of the regional trading principles and stock market directives.

The macro-economic convergence principles adopted by the EAC draws on what their forerunner unions embraced in realizing a working monetary synthesis. These unions comprise the EU, CMA, UEMOA, and WAEMU whose primary focuses were ensuring price steadiness, concerns of stable exchange and interest rates, enlarging their foreign reserves that safeguard imports, setting fiscal constraints that would control the size of deficits in the national budget, and supporting the coordination of strategies between the partner nations. The only allowable distinction between the criteria of monetary unions, is the level to which joining states are

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[4] The word criteria are used mostly interchangeably with thresholds, criterions, similarity, targets and uniformity targets to mean the same thing across and all over the document. However, they may not mean the same thing all the time. On this context they mean the criteria set by the EAMC to be met in the quest for their convergence to meet requirements for the formation of the EAMC.

permitted to differ, is to calibrate for cushioning economic disturbances (Kuteesa, 2012), a concession that EAC also adopted.

Macroeconomic convergence is indeed an overarching goal for most African states. Since independence in the 1960s, several regional economic communities have emerged. Most African policymakers consider regional integration as a crucial vehicle for promoting economic growth, improving intra-regional trade, and integrating the continent into the global economy, (Gammadigbe *et al*., 2018). Scholars present two major arguments in support of market integrations revolving mainly around fiscal convergences and monetary convergences across the globe. First, low debt ratios and fiscal deficits prevent unstable and volatile public finances from affecting other members through enforcement by the common central bank to monitor public spending, (Gammadigbe et al., 2018). For instance, member countries undergoing adverse economic meltdowns may run excessive deficits in a bid to stabilize their economies and neutralize the negative implications on other sectors such as production. However, the externalities of the deficit may have a significant negative influence on other member countries through increased interest rates in case they fail to increase public expenditure in response to the shock. Besides, *Creel* contended that fiscal policy rules serve the role of strengthening the credibility of fiscal policies, thus lending credence to the importance of coordinating policies that would lead to economic growth. Fiscal policy rules prevent conflicts of objectives, thus easing common central banks' responsibility in managing the debts of a nation and the rate of interest rates.

Macroeconomic convergence covers an array of phenomena depending on the considered analytical perspective. The two broad classifications include absolute and conditional convergence, (Simwaka, 2016). An absolute convergence supports the need for developing nations to catch up with their developed counterparts. The basis for absolute convergence glean from the law of diminishing returns on capital and perfect diffusion of technology.

Convergence can promote technology transfer between developing countries, thus assisting to attain development like the advanced economies. The emerging variation in different countries' structural characteristics which includes technology, infrastructure, human capital, natural resources, and governance, however, are deemed to promote conditional convergence for some countries, (Simwaka, 2016).

There are two major convergence analytical methods, Sigma convergence, (Mankiw, Romer & Weil, 1992), and beta convergence. Scholars and economic institutions use sigma convergence methods to assess inequalities and convergence between countries or regions, it mainly refers to a reduction of disparities among countries or regions in terms of economic variables in time, whereby the measures used are the standard deviation and coefficient variation or rather sigma (σ), which if negative, indicates convergence, (Mankiw, Romer & Weil, 1992). The method reveals that convergence exists when income per capita or any other variable of concern, converges as time goes by leading to a catch-up effect among states.

On the other hand, analysis of economic dynamics for a longer time requires beta convergence, which refers to a catching-up mechanism, which eliminates the per capita income gap between different countries. It focuses on detecting possible ongoing catch-up processes, whereby a correlation between the rate of growth and the initial level of GDP per capita has to be inverse (negative). The beta (β) if significant and negative is indicative of the beta convergence process. These methods originated from neoclassical economists who introduced the convergence frameworks to illustrate the influence of macroeconomic convergences on real GDP, (Solow-Swan, 1956). The beta framework may have resulted from absolute convergence where nations within a particular region integrate to achieve a similar steady state or conditional convergence where countries with shared initial capacity work together to realize a similar GDP per capita over a long period. Besides, the available evidence points to the existing consensus among scholars and policymakers on the progressive influence of financial

convergence for countries operating within a zone that has a currency union. The critics of the European Union's common currency such as (Ferguson & Kotlikoff, 2000) however held that debt accumulation among member countries renders the body charged with managing member states' fiscal performance, the Stability and Growth Pact, irrelevant. Fiscal policies and discipline of a monetary union members may assist countries that lose monetary sovereignty to dampen any arising asymmetrical shocks; they averred.

However, previous work on the implications of regional economic merger focused on trade while side-lining macroeconomic convergence in Africa. Nevertheless, there has been a rising population of scholars studying the topic, especially in South and West Africa. (Dion, 2004), analysed regional economic cooperation's effects on individual member nations using geographical economics and endogenous models. The analysis revealed that regional integration spurs economic growth through interregional technology diffusion and knowledge spill-overs that assist lagging countries in catch-up. The EAC and other aspiring monetary integration partners have been building upon these bases towards their realization of a regional MU.

An empirical study conducted by (Rose, 2000), found that member countries of a currency union realize enhanced trade, which is two to three times bigger than non-member countries. (Rose, 2000), alluded that MUs lead to the emergence of demand patterns that are alike with prices oscillating in the same line for member countries.

Although the establishment of the EAC started earlier, the process remained quite slow. However, the EAC Development Strategy for 2006-2010 began fast-tracking the process in 2011 with the primary aim of creating a regional MU by 2012, (Kaboro et. al., 2018). Despite the intended dates, member countries reviewed and signed another deal in 2013, expecting its implementation by 2015, which also failed to materialize. An analysis of the European

Monetary Union (EMU) reveals complications and challenges inherent after and when establishing a MU, thus signifying the need for the EAC members to ensure setting up adequate preconditions and follow the step by step to lay the groundwork for the single currency, (Alper, 2015).

The EAC member states adopted a strategic legal framework, which included the formation of various committees for the macroeconomic convergence criteria in 2007 to make the integration process much faster. The framework laid the benchmark criteria, which envisaged sustained growth, price stability, external debt limit, and fiscal, and current account deficit confines, (EAC, 2005). The member countries grouped these into primary and secondary criteria and divided them into three distinct stages as indicated in table 1.1.

Table 1.1: EAC Macroeconomic Convergence Criteria promulgated in 2007

		Stage 1	Stage 2	Stage 3
Variable	Indicator	2007-2010	2011-2014	2015 onwards
Primary Criteria	Budget deficit to GDP			Monetary union
	Excluding grants	<6%	≤5%	
	Including grants	<3%	≤2%	
	Inflation	≤5%	≤5%	
	External reserves	≥4 months import cover	≥6 months import cover	

Secondary criteria	Real exchange rates	Stable	Stable	Monetary union
	Interest rates	Stable and Market-based	Stable and Market-based	
	Real GDP growth	≥7%	≥7%	
	Public debt	Reduced to sustainable levels	Reduced to sustainable levels	
	Savings to GDP ratio	≥20%	≥20%	
	Current account (excluding grants	Consistent with debt sustainability	Consistent with debt sustainability	

Source: EAC Monetary Affairs Committee Report (2009); X implies that the criterion is considered for that stage

Economic fundamentals, such as macroeconomic variables within a country, to some extent, cause changes in the real exchange rate, which is the bridging factor to external trade, hence the significance of respecting the convergence requirements. (Howarth & Quaglia, 2021),

contended that countries that focus on reaping maximum benefit from a monetary union must ensure that these fundamentals move together. However, evidence from the EAC shows that the union's potential risks outweigh the benefits in terms of stability, costs, and sustainability, (Ng'eny, 2015). Achieving these set criteria has largely remained elusive. Analysis of member states' performance against the criteria reveals significant variations, with evidence showing that only Uganda and Rwanda have been able to realize above 7 percent GDP growth rate between 2004 and 2016, while others such as Kenya and Burundi recorded dismal performance over the period, (Kaboro et. al., 2018).

The EAMC Development Strategy team 2006-2010 set the GDP growth rate's macroeconomic convergence criterion at a 7 percent minimum and thus required member states to register at least a 7 percent annual GDP growth rate. However, a situational analysis shows that the GDP growth rate varies among the member states. Rwanda performed well in the period between the years 2002, 2008, and thereafter relapsed only to remerge in 2011-2012. Thus, from the data, Rwanda, Tanzania, and to some extent, Uganda are relatively better off at achieving the target of recording annual growth rates close to 7 percent. There is, nevertheless, the need to attain and sustain the target, which appears challenging to all the member states. Kenya and Burundi, for instance, continue to struggle with GDP growth rates much below the set criterion. However, some may argue that Kenya's performance suggests a case of an advanced partner country who has to stagnate as posited in the catch-up theory. A clear view of the scenario is as shown in Figure 1.1.
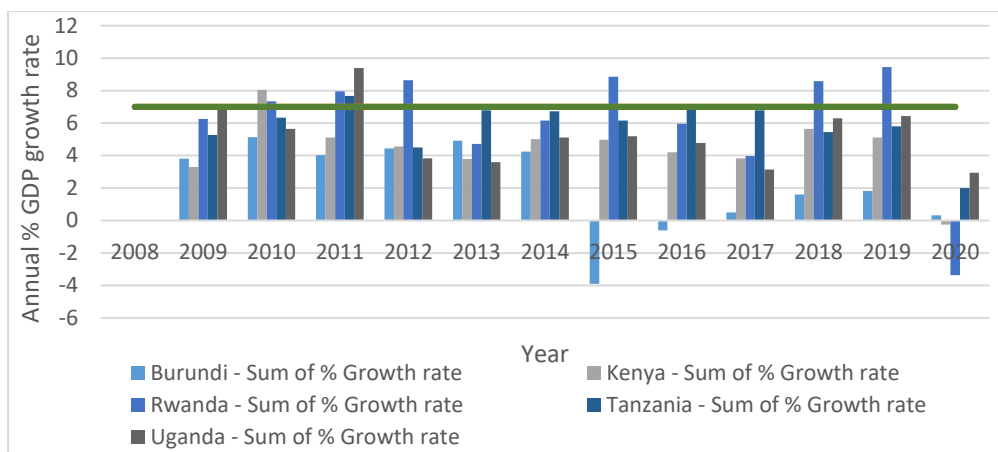
Figure 1.1: GDP Growth Rate Trends in EAC

Source: World Bank (2014) and the World Development Indicators

The significant variations in GDP expansion rates across the different EAC Partner States indicates that each country in the region pursues a unique fiscal, exchange rate and monetary policies, which pose an existential threat to a common currency policy. The countries appear to be undergoing different stages of macroeconomic convergence criteria implementation. However, the existing budgetary deficits excluding grants indicate persistent difficulties facing each country in meeting the set targets, with (Ng'eny, 2015) showing that only Tanzania managed to achieve the set GDP growth rate criterion in 2013. On overall, the results imply an underlying difficulty in attaining the EAMU thresholds.

The EAMC Development Strategy 2006-2010 had set 5 percent inflation rate with headline inflation calculated based on an all-item index while pegging core inflation on the price index, but excluding prices of highly volatile energy and food components, (Preis, 2019). However, a situational review showed the inability of member countries to realize this target, with most countries attributing persistently rising inflation rates to global increasing food prices. Empirical evidence shows that using inflation as a macroeconomic convergence criterion can be challenging given the highly volatile inflation rates, especially in developing Asian and

African countries, (Ltaifa et al., 2014). Furthermore, situation analysis reveals that only Uganda and Rwanda were able to achieve target headline inflation rates in 2017. On the other hand, Burundi entirely ignored the criterion in 2017 due to the unusual shocks, which emanated from political instability. However, in 2018, inflation rates within all the EAC countries were within the macroeconomic convergence criterion, with Burundi recording as low as 1.2 percent and Kenya recording the highest, 5 percent inflation rate; thereafter, inflation rates became unsustainable, (Preis, 2019). The trends appear in figure 1.2.

Years
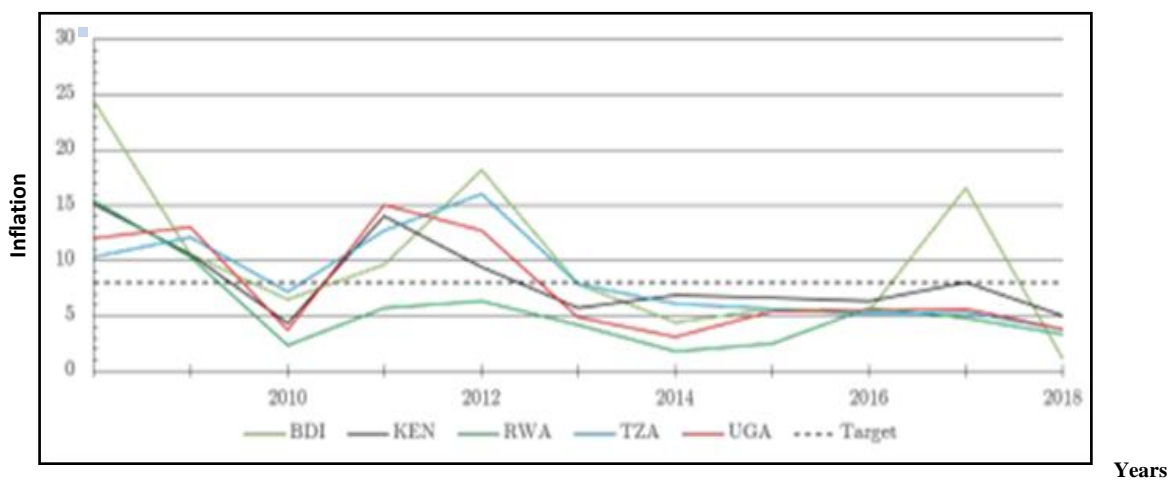
Figure 1.2: EAC percent Headline Inflation (2008-2018).

Source: IMF (2019C)

The criteria alluded here are mainly based on the Optimum Currency Area (OCA) theory. The OCA theory posits that states considering joining a MU should experience inflation patterns that correlate. Despite nearly all the EAC members achieving an inflation target of less than 5 percent in 2018, a longitudinal analysis shows that the set target is demanding given the prevailing trends in the EAC region. Empirical evidence suggests that if the EAC countries cooperate alongside some coordination, they will be able to reduce the inflation rates' dispersion, but over a long period. Nevertheless, the persistence of significant differences mainly signifies the non-convergence of real interest rates and real exchange rates, which negatively impact member nations' competitiveness regionally and globally, (Kigabo, 2018).

Fiscal convergence is essential according to OCA because after adopting a single currency policy, each country has to rely on national fiscal policy to address adverse disturbances. In this case, setting a fiscal deficit ceiling of 3 percent of GDP would demonstrate a strong fiscal stability position of each member state before the unification. Wide fiscal deficits and policies within a monetary union can also prompt extensive borrowing within the region, thus triggering and exacerbating structural problems with a negative influence on productive investment in the region, (Kigabo, 2018).

A longitudinal analysis of fiscal deficit within the EAC showed that Tanzania and Rwanda have been relatively compliant with the criterion. On the other hand, (Preis, 2019) notes that other member countries recorded mixed fiscal performance over the period with Kenya, Burundi, and Uganda experiencing significant deficits above the 3 percent threshold. Nonetheless, Kenya, Burundi, and Uganda besides Tanzania and Rwanda experienced a stable (less increasing) overall fiscal balance including grants, over the past few years, (Preis, 2019).
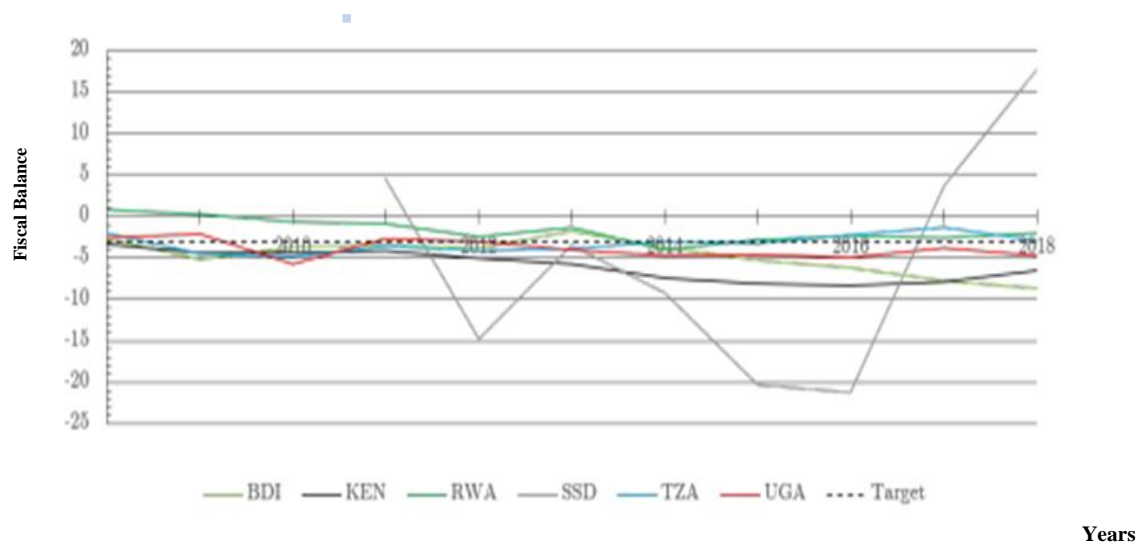
Figure 1.3: Fiscal Balance Incl. Grants of EAC Members (2008-2018)

Since most African countries finance a significant proportion of national budgets through grants, it is essential to consider the indicative fiscal deficit convergence criterion that excludes grants, 6 percent of GDP in the current case. One can consider the fiscal deficit including grants

as a distorted fiscal convergence indicator since external funding often focuses on strengthening a country's overall fiscal measure without supporting the actual fiscal performance. Fiscal deficit-excluding grants can be a useful surveillance tool that measures domestic revenue mobilization across periods, (Kigabo, 2018). Nonetheless, only Uganda and Tanzania managed to achieve a fiscal deficit excluding grants of less than 6 percent threshold with minor deviations, while the majority recorded figures above the target. Experts trace the relatively huge disparities in fiscal deficits excluding and including grants among the EAC member countries to substantial aid inflows over the recent periods to fast-track development in Africa (Ltaifa et al., 2014). Somehow, Kenya did not finance a significant proportion of its national budget using external grants within the period 2008-2018. On overall, overreliance on foreign aid poses a huge development challenge due to repayment unsustainability. Therefore, EAC members continually experience a significant challenge in fiscal convergence regarding the overall fiscal deficit, thus requiring critical structural transformations to address the challenging issues.

Besides, EAC members are also struggling to achieve 20 percent National Savings/GDP ratio. However, Tanzania recorded outstanding performance in 2010 and 2013 in this regard. Figure 1.4 shades more light on the situation.
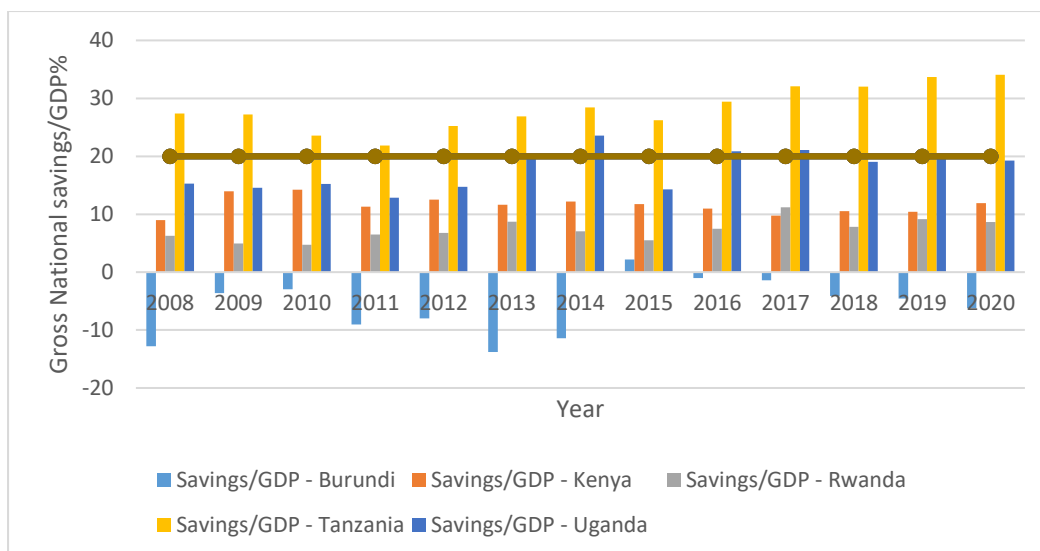
Figure 1.4: Gross National Savings/ GDP for EAC Members

The relationship between GDP and national savings is essential in encouraging fiscal discipline and minimizing incidences of external borrowing as exhibited by higher-saving nations than lower-saving ones. Therefore, the inability of member states to meet the target coupled with the significant disparities poses a greater risk to the accomplishment of the MU, (Ng'eny, 2015).

In summary, the graphical descriptive analyses indicated fluctuating economic progress of EAC countries toward the monetary union. Few members show partial convergence to the threshold criteria, while the majority remain unaligned, thus positing immense risk to the monetary union establishment. Situational analyses of the individual members show that each country is pursuing distinct monetary and fiscal policies. This is contrary to OCA postulation, which demands that states envisaging a common merger should pull in the same direction. Therefore, EAC members need to understand their underlying differences and start harmonizing their policies to achieve a more cohesive and stable establishment for the benefit of each and all member states.

1.2 Statement of the Problem

The renewed EAC Treaty was first signed in 1999 followed by a CU protocol in 2004, a CM in 2009, and a MU was to be inaugurated by 2012. Achieving the monetary union is yet to actualize, and a new target is now set for 2024, but indications are far from pointing to any accomplishment by that deadline. The EAC member states adopted a strategic legal framework, which included the formation of committees for the macroeconomic convergence criteria in 2007 to make the integration process much faster. The framework, which was anchored on the OCA theory requirements for forming the MU, laid the benchmark measures, which envisaged sustained growth, price stability, external debt limit, and fiscal, and current account deficit confines, (EAC, 2015). However, of concern is uncertainty whether the member states are achieving the specified criterion. The EAMC, which was put in place to engineer the process, has been indeed putting efforts to guide the member states on achieving the thresholds, but this does not seem to yield much. The member countries have persistently laid the blame on the thresholds of the monetary policy transmission channels and the fiscal macroeconomic variables convergence, which must be attained, but which they call stringent and untenable. The monetary policy transmission mechanisms are expected to drive the economic growth and guard the economies against high inflation rates and prices, which also influence the welfare of the citizenry. The thresholds on the fiscal variables will guard the economies and the nationals against excessive borrowing; promote export while also reducing imports.

These states and their citizenry hoped that their problems in cross border trade, persistent inflationary trends, unemployment and generally stagnated economies would partly be fixed by fast tracking the EAMU, but this has remained a mirage. Progress towards the EAMU seems to have stalled and meeting the OCA prerequisites is a major obstacle, (UNECA, 2018). This calls for further probing to prove the analogy of the lag. However, of importance is not just the delay, the problem is that member states continue seeing slow GDP and GDP per capita growth

rates, low intra-trade within the region due to high transaction costs, currency conversion risks and costs, and long bureaucratic payment procedures. In the recent past, there have been trade sanctions between Uganda/Rwanda, Kenya/Tanzania, and Kenya/Uganda. These are against the spirit of the unrestricted trade area and unlimited movement of goods, labour, and people, and the desire to share a common currency ultimately. In brief, these nations and their citizenry are not enjoying the promised benefits of the CU and the CMP, which are officially in place. The full realization of paybacks from the strides made in integration are presently repressed by numerous factors; supply-side limitations and deficiency, Non-Tariff Barriers (NTBs) and actions as well as border ineptitudes. The Partner States are lagging with the conspicuous absence of cooperation geared towards the realization of the benefits of a common trade area and eventual monetary integration. Member countries appear to be pursuing their unitary interests as is evident with tendencies to protect local firms and traders against regional competition that are partly hinged and analogous to protecting their own national economic fundamentals, including their currencies. The descriptive statistical trends also suggest that there is a continued fluctuation of the macroeconomic variables leading to non-convergence and a dearth of stability.

The other regional blocks that are struggling with the creation of a monetary union are COMESA and SADC, which are yet to be successful, yet their target was 2018 and 2016, respectively. The African continent had committed in 1994 at the Abuja Treaty that African countries would form a continental monetary union by 2021. This has also not been achieved, and we are already in 2022. This begs the question as to why regional groupings are failing in Africa. Analysing empirical data in EAC may give evidence as to why these groupings are failing to actualize their dreams of a monetary union. A check on the viability of the convergence criteria adopted as OCA theory requirements for the EAC would also shade light on the RECs problems in their pursuit of forming the MUs.

The consequences of these issues if not resolved would lead to the region lagging and losing out external trade to other regional blocks that have already put their MUs in places such as the UEMOA in West Africa, and the CMA in Southern Africa. Trade volumes will dwindle, and investors will relocate leading to a reduction of Direct Foreign Investment (DFI), with low production and high inflation rates setting in, hence, general poverty and stagnation becoming the order of the day for the economies.

Most studies including that of (Saka, 2015), only investigated aspects of convergence with a bias toward GDP. Others purely concentrated on individual macro-economic variables such as inflation, fiscal deficits, and exchange rates, among others. This study, however, analyses multi-sectoral key macroeconomic variables to establish any tendency or not, of them converging as envisioned by the EAMU targets. Therefore, this study seeks to fill the gap by a compacted holistic approach as follows; firstly, check if there is, any evidence of convergence of the EAMC targeted fiscal macroeconomic variables within the EAC, since the promulgation of the criterions in 2010. Secondly, how much has been achieved so far in the monetary sector; are the key monetary policy instruments exhibiting tendencies of stability and convergence; and, lastly, how appropriate are the convergence criteria laid by the EAMC given the EAC empirical market conditions. On overall, the findings would form a basis for the countries to evaluate the set criteria's impact on their economies and the degree, speed and sustainability of the impacts.

1.3 The Objective of the Thesis

The main objective of this thesis is to analyse macroeconomic variables including the monetary policy transmission mechanisms targeted by EAMC to establish their status of convergence and stability.

The specific objectives are:

i. To establish the presence of convergence of each of the EAMC targeted macroeconomic variables within the EAC,

ii. To determine the presence of convergence and stability of each of the EAMC targeted monetary policy transmission mechanism channels within the EAC,

iii. To analyse the relationship between the EAMC thresholds for macroeconomic variables and economic growth rates within the EAC.

iv. Recommend appropriate measures that would help the EAC realize the achievement of the convergences objective and forming a monetary union.

1.4 Contribution of the Thesis

Considering the current intrigues involving monetary mergers, the level of convergence of these variables will not only shape decisions regarding the direction of the EAC's MU ambitions but will also inform the general macroeconomic policy within the EAC region and beyond. The analysis also seeks to establish the contributions of these macroeconomic variables towards economic growth in the region, the magnitude of their impacts and speed, which will inform the policymakers where they can make quick wins that, would promote the objective of formulating a deeper common trade area at the least time possible. The macroeconomic policies are divided into fiscal and monetary policies; the monetary policies have transmission channels that are crucial in correcting market disequilibrium, determining stability, convergence, and influence GDP growth and inflationary rates, which are key to the existentiality of the economies of the region. Therefore, investigating their trends and performances are indeed crucial for the region.

Firstly, the outcome of assessing the convergence of fiscal instruments would form a basis for the fiscal authorities of the respective member states and the EAMC on the appropriate measures to adopt to realize the prerequisites for formation of the MU in the shortest time possible. Adoption of a common currency before attaining appropriate level of convergence

may be detrimental to the EACs, therefore, it's key to design and establish adequate mechanisms the member countries depend to mitigate possible asymmetric shocks once the union is formed.

Secondly, assessing the stability and convergence status of the select monetary transmission mechanism channels, would help inform the individual national central banks about their preparedness or otherwise to join the monetary union. The volatility of MPTMs are foremost causers of unreliable macroeconomic tendencies and monetary authorities may need to recheck the appropriateness of the mechanisms and redesign the hitherto dependency on them to reengineer the economies. These indeed will help them to advice on the way forward as a departure from where they have so far reached.

Thirdly, establishing the appropriate thresholds using actual data from the region will help assess the suitability of the adopted thresholds by the EAMC in terms of their performance to promote economic growth, stability and development. The outcome would inform the committee on any need to adjust the set thresholds to reflect the actual market conditions to accelerate forming the MU.

Fourthly, other RECs within the continent intending to form monetary unions would also tap into the recommendations of the study. The RECs indeed need to be sensitive to know the performance of the counterparts or peers so as to adjust early or drop altogether approaches that are not achieving elsewhere. The successful implementation of the Eurozone has made other regions develop an appetite for regional monetary cooperation. Most regional formations are using the EMU benchmarks and models for their unions, hence the need to assess the emerging unions' such as the EAC; their successes and their shortcomings up to where they have reached so far. Therefore, there is need to know if indeed the borrowed models or thresholds are working for them or not. Most noteworthy, the research draws inspiration from

concerns within the EAC as well as from groupings in other regions, seeking professional guidance in assessing and advising on the most suitable techniques and thresholds that they can adopt to achieve the desire for the regional financial cooperation, more so, with evidence from the most current data.

In addition, Development Partners of the joining parties would also be interested to know emerging issues in the merger processes to decide when and where to assist to enable the joining parties succeed on their drive to unite. The international community are also concerned about the progress of their development, trading and/or such future partners.

Lastly, scholars and researchers may tap into the thesis to fill the literature and methodological gaps in this line of study that undertook a holistic approach, mainly whereby multi-sectoral issues are condensed as an all-in-one process covering various variables and member countries of a region willing to join together. In summary, this study analyses multi-sectoral key macroeconomic variables to establish any tendency or not, of them converging as envisioned by the OCA theory, EAMU and other RECs using threshold targets. Additionally, the study is using the most recent data to achieve the most recent econometric dynamics from the EAC.

1.5 Organization of the Thesis

The remaining part of this thesis has three essays and one chapter. Chapter 2 (Essay 1) presents the status of fiscal macroeconomic variables convergence within the EAC. Then Chapter 3 (Essay 2) presents the status of the monetary policy transmission channels' stability and convergence within the EAC. Chapter 4 (Essay 3) involves the examination of the suitability of the set thresholds to the regional market operations and their impact on the GDP growth rate. Chapter 5 provides the summary of the findings, conclusions and policy implications.

CHAPTER TWO
THE CONVERGENCE OF MACROECONOMIC VARIABLES WITHIN THE EAST AFRICA COMMUNITY

2.1 Introduction

Interest in the integration of countries in the same region like EAC has grown tremendously over the decades in the aftermath of independence in Africa and even globally with different unions having been established. The visions were triggered by the drive to have more influence on the global stage and generally the relatively small size of individual economies which inhibit countries from enjoying the benefits of operating on a large scale both in producing goods and in the sale of the commodities abroad, (Dion, 2004).

The Central Africa Communaute Financiere d'Afrique (CFA) Franco zones, which comprises countries previously colonized by the French, and the Common Monetary Area (CMA) established in Southern Africa are the only existing regional currency unions in Africa. However, other regions are also emphatically trying to establish their own. The following regional blocks are in the pipeline: The ECOWAS, the COMESA, the SADC, and the EAC. All these unions have the eventual intention of having a shared currency for the African continent, (Masson & Pattillo, 2004).

When countries establish a monetary union successfully, they realize a reduction in the exchange rates amongst themselves, economies of scale because of the regional pool of resources, price harmonization in the region, and generally, the traders will not be subjected to exchange rate risks, (Rose, 2000). The members in a monetary union must, however, be ready to lose their sovereign right to alter their monetary policies at will; that is, they will not also be able to effect changes that will lead to changes in exchange rates. More so, these nations are likely to be faced with asymmetric shocks and a uniform monetary policy cannot be seen as a panacea to all these. That is, these countries will not have the power to alter monetary policy

instruments and policies that affect the exchange rates that are traditionally used to address country-specific macroeconomic shocks.

For the long-term objectives of a sustainable MU to be realized, the EAC has to achieve fiscal macroeconomic convergence. In addition, for the union members to be deemed to have achieved a MU, they must exhibit monetary policy convergence, and this needs to be exhibited by similarities in the rates of exchange and interest rates as part of macroeconomic instruments. (Rose, 2000) concluded that a MU is beneficial to members since it brings about increased trade because of increased demand as a result of price stability.

When countries join a MU, they tend to become more alike and association amongst them becomes easier. However, when analysing countries for suitability to be members of a MU, and their characteristics are found to be endogenous, meaning they can absorb symmetric and asymmetric shocks, then it is normally concluded, these nations do not necessarily need to satisfy the OCA Theory criteria[5] for the union to be adopted. However, the near opposite was evident when the European Monetary Union (EMU) was being founded and a few countries were allowed based on endogeneity; the subsequent gains particularly expectations on intra-trade were dismal, only 15 percent, (Chintrakarn, 2008) and (Frankel, 2008). (Carmignani, 2010) and (Tapsoba, 2009), to establish the consequence of endogeneity on trade for the existing African MUs, conducted the same analysis. They found out that it increases the way business cycles are synchronized but the overall gain was dismal.

Nonetheless, it is noteworthy that when the Euro area was established in the year 1999, not all countries that joined the union did adhere to the OCA conditions. When these countries joined the union, they had huge disparities in unemployment rates, labour productivity, and GDP growth. States in the USA also had more similar characteristics in their financial market, the

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[5] Optimum Currency Area (OCA) Theory: espouses the conditions necessary for a region to qualify as an OCA so as to benefit from shared currency.

goods market, and the factor market compared to countries in the Euro area. Therefore, if the OCA conditions could have been adhered to, the adoption of EMU could have been postponed or at worst abandoned.

Other authors contend that the OCA criteria are not the best way for considering countries to join a MU. (Frankel & Rose, 1998) postulated that countries' ability to meet the OCA requirements would largely be affected by the economic policy regime of a nation. They contended that these criteria can be met ex-post rather than ex-ante. This was further supported by (Frankel and Rose, 1998), who claimed that the OCA criteria only focused on money aspects emanating from a private sector perspective of cost minimization and therefore not a solution.

Even though the drawbacks of endogeneity may not be quantified, the finding of insignificant impact is a warning that countries should not be so engrossed with the idea of forming a MU. Within the EAC, empirical findings show that to date, since the introduction of the criteria, trade benefits are only 15 percent more; the inter-EAC trade is quite low and worse off because these nations mostly depend on primary products. Due to the dependence on primary products, to reduce any negative impact due to reduced control on monetary policy instruments by countries that are members of a MU, convergence before a monetary unification is still essential for the EAC. From this perspective, it follows that at this stage, in time, the review of the possibility for macroeconomic convergence and growth in the EAC has to be done with a focus on the trends of the targeted variables requiring convergence.

Less-known work have been conducted to test the convergence of macroeconomic variables set out at the launching of EAMU in 2010. Nonetheless, due to expectations that the set convergence criteria which include those of annual GDP growth rate, inflation rate, national savings, budgetary deficit, and foreign reserves would play a crucial role on the much needed

monetary union and economic growth in the region, it is important that their trends are followed closely.

2.1.1 Trend Analysis for the Target Macroeconomic Variables in the EAC

The basic situational statistical behaviour of the targeted macroeconomic variables in terms of convergence, the thresholds notwithstanding, for the EAC economies are displayed in Figures 2.1, 2.2, and 2.3.
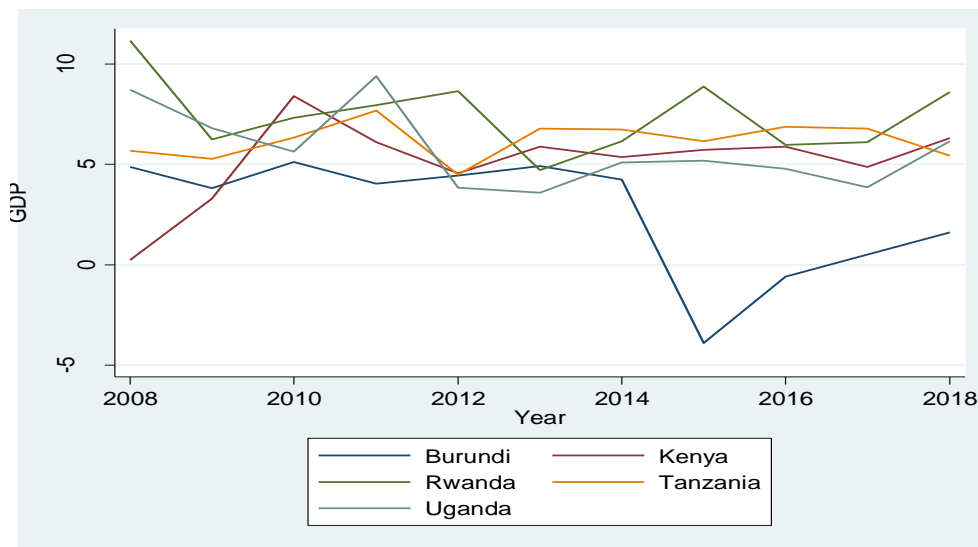
Figure 2.1: GDP Growth Rate for Burundi, Rwanda, Uganda, Kenya, and Tanzania

Source: Author's analysis using WDI data
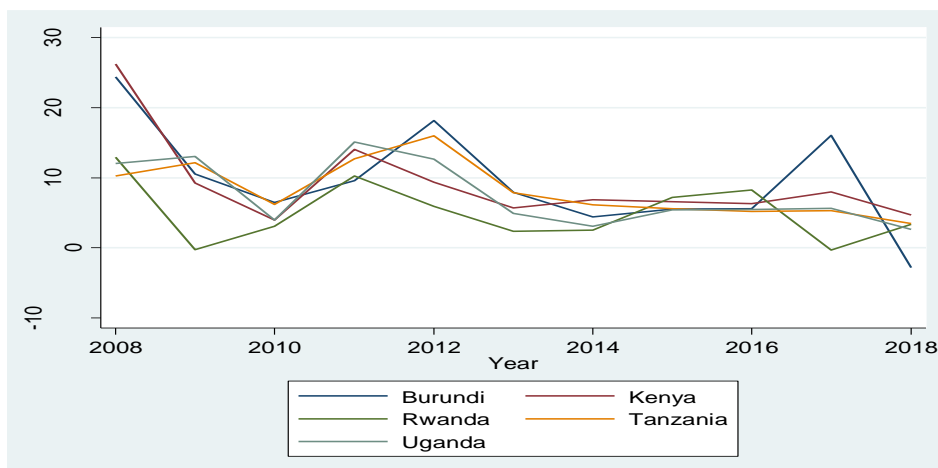
Figure 2.2: Inflation Rate for Burundi, Rwanda, Uganda, Kenya, and Tanzania

Source: Author's analysis using WDI data
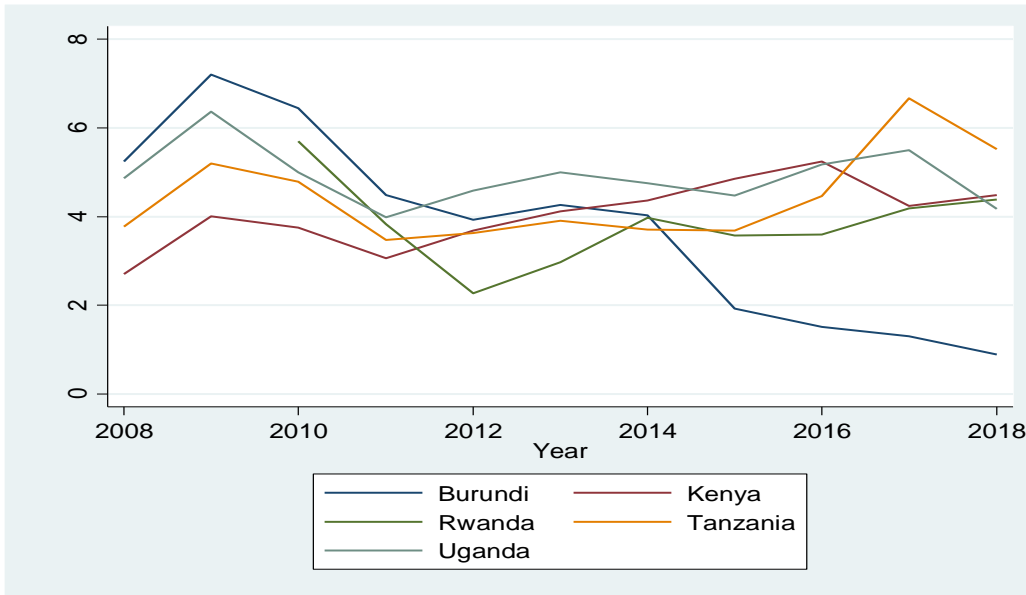
Figure 2.3: External Reserve for Burundi, Rwanda, Uganda, Kenya, and Tanzania

Source: Author's analysis using WDI data

Figure 2.1 showed clear dispersion in the behaviour of the GDP expansion rate within the economies of EAC. The inflation rate for the five economies within EAC followed a similar pattern for the period 2008-2018 as depicted in Figure 2.2. Figure 2.3 on foreign reserves showed a mixed outlook with 3 out of 5 members showing better trends of convergence which appear unsustainable as they seemed to be headed in opposite directions in the long run. However, the data generally exhibits stationarity trends for each of the macroeconomic variables of interest, spuriously pointing to some sort of stability, but these have had to be proved through further statistical econometric tests.

2.1.2 Statement of the Problem

The renewed EAC Treaty was adopted in 1999, a Custom Union protocol in 2004, a Common Market Protocol (CMP) in 2009, and an objective to form a MU by 2012 was agreed. The member countries laid a framework, which anchored on the OCA theory requirements for forming the MU. Taking a glance at the EAC situational analysis of trends, both in terms of convergence and meeting threshold criteria, none of these benchmarks seems to be achievable.

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The member countries have persistently laid the blame on the thresholds of the monetary policy transmission channels and the fiscal macroeconomic variables convergence, which must be attained, but which they call stringent and untenable. The monetary policy transmission mechanisms are expected to drive the economic growth and guard the economies against high inflation rates and prices, which also influence the welfare of the citizenry. The thresholds on the fiscal variables are anticipated to guard the economies against excessive borrowing; promote export while also reducing unnecessary imports into the region, thereby improving the balance of payments.

These states and their citizenry hoped that their problems in cross border trade, persistent inflationary trends, unemployment and generally stagnated economies would partly be resolved by fast tracking the EAMU, but this is not forthcoming. Looking at the trends in terms of trade relations and geopolitics in the recent past, there have been trade sanctions between Uganda/Rwanda, Kenya/Tanzania, and Kenya/Uganda with some continuing to date. These go against the common market ethos, where there are ambitions for a MU in the long-run. Consequent to the trends, it is pivotal to investigate key fiscal macroeconomic variables within the EAC and understand their behaviour, to come up with policy recommendations that may help these nations shape a common approach to realizing their dreams.

Preliminary check on empirical research on economic convergence found that most studies focus on GDP convergence. Probably this is because some findings have stressed more on the importance of real GDP growth rate in macroeconomic convergence. Scholars like (Amurgo-Pacheo & Pierola, 2007) and (Nwosu *et al*., 2013) determined that macroeconomic convergence heightens the growth rate among states with low and average incomes as compared to nations with high incomes. Available corroboration shows that while developed countries experienced a high average annual gross domestic product growth at 2.7 percent in the 1990s, the figure reduced to 2.3 percent between 2000 and 2008 ("Economic

Convergence"). These countries included the United States, the European Nations, Japan, and Canada. On the other hand, developing nations such as China, India, Ireland, and Jordan averaged a gross domestic product growth of 5 percent between 1990 and 2008. Interestingly, each of the sampled countries can connect their economic growth to unique factors, including capital and human investment, market forces, technological gains, and government policies, justifying an overall macroeconomic convergence pattern according to exogenous theories, (Burgess, 2009). The under-developed countries have a faster GDP growth rate than middle-income countries, which also have higher GDP growth rate than developed nations.

The convergence of macroeconomic variables has been researched elsewhere in Africa, mainly in West Africa and Southern Africa, but still without focusing specifically on the convergence of multiple set of macroeconomic variables such as those targeted for the initiation of the EAC monetary union. Several studies for instance, those of (Kumo, 2011) and (Mainza, 2017) analysed aspects of nations' economic convergence with a particular interest in GDP only.

This research aims to investigate all the fiscal macroeconomic variables vital to the formation of the MU and establish whether there are any trails to convergence as envisioned by the EAMC agreements. The member countries are lagging with an apparent lack of cooperation amongst them to realize the benefits of a common trade area, and adherence to the recommendations to achieve a monetary union. The Partner States appear to be pursuing own interests and, in some instances, there are tendencies to mainly protect local firms and commercial businesses against the regional competition, which is generally retrogressive.

The study sought to evaluate how the specific macroeconomic factors are responding in terms of the desired trends and directions deemed conducive to the realization of a shared currency. The analysis provided empirical evidence focusing on the convergence necessary for macroeconomic variables to realize economic convergence, not just beyond the targets, but

holistically in a manner that would lead to an eventual deeper Economic Union and later a Political Federation.

2.1.4 The Research Objective

The overarching aims of this chapter was to demonstrate the status of convergence of the macro-economic variables that are prerequisite to forming the intended monetary union.

The specific objectives:

a) To test presence of convergence of each of the EAMC targeted macroeconomic variables within the EAC.

b) To test for the speed of convergence of each of the EAMC targeted macroeconomic variable within the EAC.

c) To establish existence of a common trend of each of the EAMC targeted macro-economic variables within the EAC.

2.2 Literature Review

2.2.1 Theoretical Literature Review

The basic prototype of macroeconomic convergence originated from the (Solow-Swan, 1956) Neoclassical Exogenous Growth (NEG) model. The theory postulates that as economies accumulate more capital, they become less productive, unlike the ones that are relatively poor with a lower capital-to-labour ratio. This implies that in cases where countries have the same choices and level of technology, over time, they later reach the same steady state levels of growth rates as long as they can both access and utilize the same technology. This scenario is absolute or unconditional beta convergence, because there is no endogenous control of the differences such as technology, infrastructure, human capital among others, between the countries, (Romer, 2012).

The Solow model employs the Cobb-Douglas production function to explain how the output is influenced by changes in capital and labour. Labour knowledge is influenced by the level of technological advancement and output increases as a result of an increase in capital stock. Output is not entirely consumed. That is, a fraction is saved and invested as new capital resulting in growth in the level of output. Growth in capital stock is dependent on savings less depreciation and population growth. The stock of capital can only increase to the extent that it attains a steady state and thereafter the economy will not realize further growth as demonstrated by Figure 2.4.
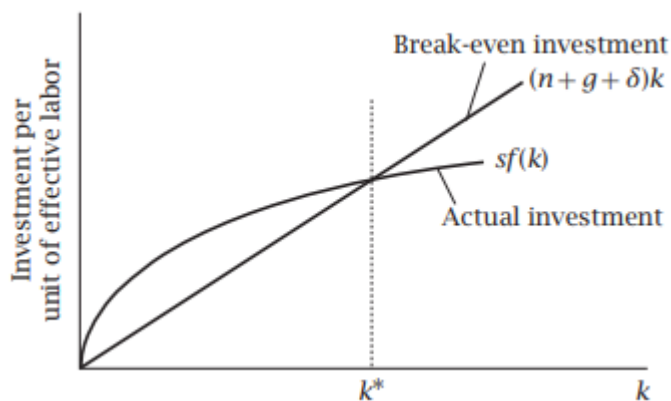
Figure 2.4: Actual and breakeven investment

From the diagram, when investment $(sf(k))$ is greater than the rate of depreciation and the growth of population, the level of the stock of capital continue to grow to the point that it interacts with the break-even investment curve at k^*. After that point, further investment will not lead to more growth but replace depreciating stock. At the steady state, capital and investment are equal such that no further capital can be created due to the state of the economy, which has attained its maximum capital accumulation level. At this juncture, less developed countries will benefit from technology and capital diffusion from the developed countries that have attained a steady state, (Romer, 2012).

On the contrary, the Exogenous Growth theory[6] posits that, taken as a factor within the model, technology is subject to rigorous decision-making at individual firms such that each country can generate different levels of income towards the level of convergence. This scenario is called conditional beta convergence and it applies to situations where states are differently endowed with factors other than just the level of capital (e.g., institutional structure, good governance, environment, natural resources, soft and hard infrastructure, human capital and social capacity), coming into play as controllable variables, (Mainza, 2017).

In addition, the concept of convergence interacts with formation of a MU through the Optimum Currency Areas (OCA) theory. The OCA theory was brought out by (Mundell, 1961) and further supported by McKinnon (1963), and thereafter by (Kenen, 1969). The idea was to establish the conditions under which a nation would most likely benefit by joining a currency union. The theory argues that for a nation to be a member of a currency union, it has to ensure that it has weighed the balance of the loss of economic stability and sovereignty to adjust its monetary policies, against the gains of a monetary union. These gains are brought about by competitive advantages because of the decline of the general price level, the increases in overall demand, and intensified exports because of being a member of one currency.

However, if the integration process is not conducted with care, poorly integrated members are likely to experience asymmetric macroeconomic shocks. An asymmetric shock happens when some member countries in the union are hit by a shock while others are not. If some of the member countries were affected by positive or negative demand shocks, this would lead to disequilibrium because of price variation in the affected countries. When the union central bank tries to help the affected countries by increasing their money supply to help them regain economic strength, this would only lead to inflation that impacts part or the entire regional

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[6] Theoretical developments in the economic growth literature from exogenous to endogenous and back to exogenous growth models that are studied currently, six (6) key determinants are identified to account for international productivity differences. These include 1) technology 2) innovative and intellectual capital; 3) human capital, fiscal policy; 4) monetary policy; 5) trade; and 6) financial factors.

union. The intention of the unitary central bank to resuscitate the ailing nation can salvage an economy from economic turmoil but at the cost of increased inflation. Therefore, if there were asymmetric shocks, the unitary central bank's monetary policies to salvage some countries in the union would only be at the expense of the others. These are indeed the reasons behind the OCA prerequisite conditions, which must be met by members intending to join a MU.

2.2.2 Empirical Literature Review

In Africa, researchers in the ECOWAS, SADC, and EAC regions pursued the benefits of economic and monetary unions. (Saka et. al., 2015) investigated if criteria established by the ECOWAS, under the West African Monetary Zone (WAMZ), were leading toward macroeconomic convergence. The study used the Keynesian framework as the analytical model, whose basic assumption captures the supply and demand side of the economy, and incorporates the variables such as investment, fiscal deficit, inflation, exchange rate, interest rate, and labour in explaining the economic growth rate. In the WAMZ scenario, the study also added financial reforms and trade openness due to the then pursuit of liberalization policies by member states. The data was downloaded from the World Bank website known as World Development Indicators (WDI) and supplemented by the Ministry of Finance and the Bureau of Statistics in Nigeria. For diagnostic tests, the researcher performed Normality Test (J-Q test); Serial Correlation (LM test); Heteroscedasticity (ARCH), and Stability (Cusum square) tests. Except for Nigeria's fiscal deficit, all variables and GDP growth rate were discovered to be significantly correlated using panel co-integration tests, (Saka et. al., 2015).

Another study in ECOWAS by (Mati et. al., 2019), investigated the process of establishing a monetary union with a special interest in the convergence criteria using data drawn from the 2000 to 2008 period. They adopted a neoclassical growth model in explaining the conditional convergence among the member states. The panel estimation aimed to show the effects of all explanatory variables on the income growth rate. The findings showed that the central bank

debt financing harmed the income growth rate with a unit increase in deficit financing inducing a 0.03 percent decrease in income rate. The fiscal deficit also harmed the income growth rate with an increase per unit in fiscal deficit leading to a 0.11 percent decrease in the income growth. The effect of external reserves on the income growth rate was negative but not significant. Therefore, all the explanatory variables had indirect and negative effects on the income growth rate in the ECOWAS region.

(Kumo, 2011) examined the convergence of real per-capita income GDP and activity of macroeconomic variables in the SADC region, using data drawn from the 1999 to 2009 period. Using standard deviations, the tests disclosed the absence of sigma convergence by employing both real GDP per capita and purchasing power parity (PPP). Results implied that the disparities in real income increased over the study period, as some countries grew richer and others poorer. For beta convergence, employing a sample of 11 SADC states and using Generalized Least Squares, (Kumo, 2011) found that there was no conditional beta convergence. Another study, in the same region, examined the suitability of the SADC macroeconomic convergence criteria. The descriptive analysis indicated positive progress in 2009 and 2010 in meeting inflation targets, but inferential statistics indicated that member states would not be able to meet the targets.

Furthermore, (Mainza, 2017) conducted a study to assess the convergence of real per capita GDP in the face of differences in the structural outlook across SADC member countries (conditional beta convergence) and the likelihood of reducing income dispersions (sigma convergence). The theoretical framework adopted was the growth model built on the original Solow model. He obtained the statistical information from the World Bank, IMF, and 15 member countries' central banks and bureau of statistics institutes. The variables of interest in the study were average years of going to school for the population aged between 25 and 64 years for human capital and gross capital formation. Based on the panel estimation, there was

conditional beta convergence among SADC countries, since the log per capita GDP (β) coefficient was, 0.905, which satisfies the condition that the conditional β-convergence requirement is in the range 0<β<1. Further, the accumulation of human capital was also significantly and positively correlated to the growth in GDP in the short and long run, in the SADC zone, indicating movement in the right direction.

Extensive research has been done in the EAC over the past two decades. Three East African nations (Kenya, Uganda, and Tanzania) participated in a study on the feasibility of a MU undertaken by (Mkenda, 2001). The study involved analysing the fulfilment of the OCA criteria by employing a Generalized Purchasing Power Parity (GPPP) model suggested by (Zerihun & Breitenbach, 2018). The model sought to explain elements of real exchange rates and the essentials of an economy, like income and trade conditions, which should trend together for a region to be considered an OCA. The co-integration of the real exchange rates of the OCA member nations was the question sought. The study inferred that the EAC was not an OCA. The analysis in the study suggested a lack of co-integration in the real exchange rates from 1981 to 1998. This means that they were influenced by similar stochastic trends. Nonetheless, this may be justified given that the market price and nominal exchange rates were directly or indirectly controlled by respective governments, and therefore may not have trended freely as expected.

(Buigut & Valev, 2005) first analysed the symmetry and asymmetry of macro-economic shocks for the EAC (Uganda, Kenya, Tanzania, Burundi, and Rwanda) applying the bivariate SVAR approach. The methodology followed the one that was also used by (Bayoumi & Eichengreen, 1992). The data that was used ranged from 1970 to 2001, which comprised real GDP and real GDP deflator. Their analysis showed that EAC was dominated by asymmetric shocks, positive and significantly correlated supply shocks were evident only in Kenya and Burundi. They

concluded that it was not possible for a monetary union to be established and they recommended the necessity for more integrate.

(Mburu, 2006) analysed whether the political atmosphere and economic conditions would favour the establishment of a MU in the EAC region. The method of analysis involved alignment of the economic cycles and shocks matrix. The study deduced that the adoption of an OCA would not be appropriate given the prevailing conditions. He discovered no proof of macroeconomic confluence among the EACs, the reasons that he gave were low intra-regional trade, the level of factor mobility were low, and the countries in the EA region did not have political and institutional structures that would support a monetary union.

(Debrun et al., 2010) came up with a comprehensive cost-benefit analysis to analyse monetary integration that was aligned to data available in Africa. They used their developed model on the existing monetary unions and the proposed unions that included the EAC. They found out that EAMU would be of minimal benefit to the member countries save for Tanzania. The reason is that each nation has an effective central bank that is independent and targets a lower level of inflation of its interest. They also established that the level of asymmetry in economic disturbances is less in EAC than in the other blocs. Generally, there was a higher correlation within the EACs from 1990 to 2007 than that of WAEMU and CMA in the prevailing African MUs. The findings also showed that these correlations have a downward trend from 2006 to 2008. This showed that the countries developed different export patterns due to decline in commodity prices.

In a different study, (Demirbas & Kabananiye, 2011) established that EAC countries were converging toward a common trend. In a test of the convergence of per capita GDP, the results were mixed. Preliminary results showed that EAC countries' GDP per capita for the duration of 1980–2007 was approaching zero. However, generally, the mean convergence of real GDP

fluctuated between -0.60 and 0.80 showing that the means were not approaching zero. Hence, there was no clear indication of convergence.

(Mafusire & Brixiova, 2013), assessed the preparedness of EAC for a monetary union whereby they applied a structural vector autoregressive model with a keen interest in macroeconomic shocks in the region. The findings suggested that the level of asymmetry in macroeconomic shocks affecting the region was very low with a recommendation that the EAC should not rush into a MU, but instead focus on more economic convergence.

(Sheikh, 2014) conducted a similar study, where he analysed the suitability of the region with concerns about OCA variables. The study employed a four-variable regression (SVAR) model to analyse four distinct shock categories, which included domestic demand and supply shock, monetary supply shock, and global supply shock. He then analysed these shocks' symmetry and asymmetry correlation by utilizing a straightforward method, followed by impulse response analysis, analysis of variance decomposition, and finally one-way ANOVA analysis.

(Sheikh, 2014), proceeded to apply a second method, which involved economic cycles' alignment analysis of Hodrick-Prescott (HP) and the Bandpass (BP) filters. He first established the cycle trends, and then applied them using correlation analysis across countries, and variance analysis to check if the EAC was affected uniformly by business cycles or not. His findings were not significant and therefore not supportive for the formation of a MU at that moment but indicated a promising future for the same. These, were supported by the fact that the shocks became more symmetrical with time and the business cycles had appeared to co-integrate more closely in the region for the previous ten years that had passed. The correlation analysis for shocks showed that the domestic demand and external demand shocks were aligned in the EA region. The output for business cycle analysis exhibited that EACs were similar in cycle components but have a difference in permanent variables in the growth trends. The study

recommended that EAC countries should develop an institutional framework that if well thought out might result in the creation of a central bank for the region that would be more independent than the existing national central banks. Different nations employ different fiscal measures to curb budgetary deficits, and having a common central bank within a MU would better resist the need to borrow from outside than from national central banks.

(Dridi & Nguyen, 2017) scrutinized inflation convergence in five EAC nations and in particular, the study focused on Rwanda, Uganda, Tanzania, Burundi, and Kenya. The paper studied convergence in inflation using Global Vector Autoregressive (GVAR). The GVAR model was used in this study on the merit that it explores the various channels and inter-linkages. The findings from the study showed that price rise disparities among the EAC nations are not of importance, which implied a price change convergence. The convergence is attributed to a correspondence in the type of disturbances affecting EAC nations, and the type of foreign variables as movers of price fluctuations providing that inflation has been low and also less unpredictable in industrialised as well as in developing nations ever since the early 1990s.

2.2.3. Literature Overview

The studies reviewed included those that used diagnostic tests, such as performing Normality Test (J-Q test) and Serial Correlation (LM test); Generalized Purchasing Power Parity (GPPP, the bivariate SVAR approach, a method that involved economic cycles' alignment analysis of Hodrick-Prescott (HP) and the Bandpass (BP) filters. Finally, others used Global Vector Autoregressive (GVAR).

Empirical literature reviewed indeed demonstrates that most analyses used mainly resonated with the Solow-Swan and the Keynesian based methodologies, which have also been used in this study. They also used almost most of the various convergence methodologies of the growth theories available so far. However, most of them checked the convergence of mostly one

macroeconomic variable at a time, often the per capita income, real GDP, real interest rate, real exchange rate and inflation of nations. In addition, most of them largely analysed rationality of the time series data, but hardly looking at the statistical co-integrations, stationarity and variation, hence the reviews being more qualitative than quantitative in nature. This study takes a divergent approach by analysing multiple variables using panel data, which has both time series and cross-sectional dimensions unlike most reviewed studies that largely used time series data. This method controls for endogeneity, unobserved heterogeneity and stationarity and therefore yields estimates that are more robust than those from standard panel data methods or time series methods. Specifically, the analysis entailed testing for stationarity and co-integration using various available methodologies to boost impeccability.

2.3 Methodology

2.3.1 Theoretical Model

This essay builds upon the Solow model. The Solow model postulates that growth is influenced by capital (K), labour (L), and technological advancement (A). The approach assumes a Cobb-Douglas production function at a given point in time:

$$Y(t) = K(t)^\alpha (A(t)L(t))^{1-\alpha} \quad 0 < \alpha < 1 \qquad (2.1)$$

In the equation, Y is output, L is labour, and A is the technology level. The following are taken as exogenous; savings, population growth, and technological progress. L and A are presumptively growing at the rate n and g defined at a given time t by:

$$L(t) = L(0)e^{nt} \quad (2) \qquad \qquad A(t) = A(0)e^{gt} \qquad (2.2)$$

The two equations imply that effective labour $A(t)L(t)$ grows at a rate $n + g$ with output increasing in the stock of capital (K). The model assumes that output was not entirely consumed since a fraction, s, is saved and invested. Defining k as the stock of capital per effective worker, $k = \frac{K}{AL}$, and y as the level of output per effective worker, $y = \frac{Y}{AL}$, the rate of change in capital per effective worker can be expressed as:

$$\dot{k}(t) = sy(t) - (n + g + \delta)k(t) = sk(t)^\alpha - (n + g + \delta)k(t), \qquad (2.3)$$

The level of investment in the economy was given by $sy(t)$ and the rate of growth of population and depreciation is given by $(n + g + \delta)k(t)$. According to equation (2.3), if the level of investment is greater than the rate of depreciation and population growth, a nation's capital stock will only increase to the level where k converges to the steady-state k^*, at this level investment is just enough to replace the depreciated old stock of capital. This level can be expressed as:

$$k^* = \left[\frac{s}{n+g+\delta}\right]^{1/(1-\alpha)} \qquad\qquad (2.4)$$

The sustained capital per effective worker is positively connected with saving rates and inversely related to population growth rates, according to the equation. When an economy gets to this level, investments and depreciation are equal and no new capital is created because the economy has reached its maximum level of capital stock accumulation. Given that the effective labour $A(t)L(t)$ is taken as constant and output (Y) increases due to an increase in capital stock, then, capital in its stable condition determines the steady-state level of output.

Taking Equation (2.4), substituting into Equation (1), and taking the log of both sides, the steady-state income per capita is given by;

$$\ln\left(\frac{Y(t)}{L(t)}\right) = \ln\big(A(0)\big) + gt + \frac{\alpha}{1-\alpha}\ln(s) - \frac{a}{1-\alpha}\ln(n+g+\delta) \qquad (2.5)$$

As stated by the equation, the constant extent per capita is influenced by technical advancement and investments both favourably and inversely by population growth and depreciation rates. The model forecasts that long-term economic trends will lead to steady-state per capita income levels, which are directly affected by the long-term steady-state of capital.

2.3.2 Empirical Model

The empirical model, was divided into stages where the analysis is as follows: first tests are for the presence of convergence, then analyses the speed of convergence, and finally, conducts for stochastic convergence (unit-root tests and co-integration)

2.3.2.1 Macroeconomic Variables Convergence

The convergence is estimated using Sigma and Beta convergence. Sigma convergence (σ) measures how countries' macro-economic variables are converging over time; i.e how their differentiation decreases over time. Beta convergence (β) is said to have occurred when developing nations become more advanced at a faster rate than more industrialized nations, whereby the initial income is negatively related to the per capita growth rate of the economy, this form of convergence can either be absolute (unconditional) or conditional.

Variables are said to be conditionally convergent when determinants of convergence are controlled in the model, Mankiw et al. (1992). On the other hand, absolute convergence happens when the national outputs converge to a steady state without controlling for the factors that affect the change in them. Countries can realize β convergence and fail to realize σ convergence because; β convergence is a prerequisite, but it is not sufficient condition for the realization of σ convergence. This means that countries may realize β convergence and fail to realize σ convergence. This paper analyzed both absolute and conditional convergence.

Sigma Convergence (σ): The macro-economic variables dispersion is measured by analysing the standard deviation or variation (coefficient of variation (CV)) of the macroeconomic variables in the economies. The study investigated the decline of coefficient of variation for the macro-economic variables per capita throughout of the study, which is given by:

$$CV = \frac{Standard\ deviation}{mean} \qquad (2.6)$$

The convergence hypothesis was tested by estimating the trend line of the co-efficient of variation over time for the EACs given by:

$$CV = \alpha_0 + \alpha_1 t + \varepsilon_t \qquad (2.7)$$

The predictor variable is the length of time used for the study, while the predicted variable (CV) is the coefficient of variation for the macroeconomic variables for the EACs: $t = 1, \ldots\ldots, 10$ for the years between 2008 to 2018, and the error term is given by ε_t. The presence of convergence is supported when the coefficient α_1 is negative.

Beta Convergence(β): To measure β convergence, the model is generally based on the annual growth rates of GDP, which are regressed on the GDP levels of the previous years. In the absolute case; the control variables are not added and for the conditional convergence, the control variables are added.

$$log y_{it} - log y_{it-1} = \alpha_0 + \alpha_1 log y_{it-1} + \sum_{k=1}^{n} \emptyset_k x_{kt} + \varepsilon_{it} \qquad (2.8)$$

From the equation 2.8;

i. $logy_{it}$ is the natural logarithms of GDP per capita in a given state i at time t,

ii. α_0 is constant (autonomous change) or the intercept,

iii. x_{kt} is the vector of control variables, and

iv. ε_{it} is the error term.

The analysis employed Fixed Effects Model, using panel data. For the absolute convergence, the analysis was done without the control variables x_{kt}, and in the case of conditional convergence, the control variables were added.

For β convergence to be evident the value of α_1 has to be negative ($\alpha_1 < 0$) demonstrating that a greater initial income levels adversely affect the rate at which the GDP growth rates for the following years. In this analysis, the model was extended to each of the variables requiring convergence across the countries.

The Speed of Convergence: To establish the speed of convergence, Equation (9) was used to estimate the β coefficient.

$$\beta = -\frac{1}{T}\ln(1 + \alpha_1 T) \qquad (2.9)$$

For the panel data $T = 1$. β measures the distance from the steady-state for the economies that are converging in some given years.

2.3.2.2 Stochastic Convergence

This study further investigated the trend of convergence by conducting unit root tests, and subsequently, co-integration tests. The unit root test checks whether the variables are stationary while the co-integration test checks for the presence of a long-run relationship in the macroeconomic variables.

i. **Unit Root Testing**

Unit root test was used to explore whether the time series are random or stationary (stable). For this, a Stochastic Process Model (varying in a random manner) is used which is specified as:

$$y_{it} = \alpha + \phi y_{it-1} + \varepsilon_t \qquad (2.10)$$

The null hypothesis is $Ho: \Phi \neq 1$. When a time series has $\Phi=1$, the model is random (therefore not stable). When the null hypothesis is accepted, it implies that the model is stationary, therefore stable and it means that the time series is converging to a stable state. Therefore, we check whether the model $\Phi = 1$ (unit root) or not $Ho: \Phi = 0$.

ii.   Analysis of Co-integration

After checking for the existence of a unit root and confirming that the time series variables are random, there is need also to check whether the random variables have a common trend in the future (are they converging in the future?) or rather, are they co-integrating? The idea is to then check whether the time series variables are converging (co-integrating) in the long run.

$$x_{i,t} = \beta_0 + \beta_1 x_{-i1,t} + \beta_2 x_{-i2,t} + \cdots \ldots + \beta_3 x_{-ik,t} + \varepsilon_t \qquad (2.11)$$

Where; $-i, t(t = 1 - - - - - k)$ represent time series of i at time t. In estimating the above model, only time series that are integrated of order 1 i.e I (1) were included in the analysis. The analysis employed various tests to find out the order of integration when conducting the unit root test. Co-integration is supported by establishing $p - 1$ co-integrating vectors, in the time series data; p is the total number of time series variables that are included in the model. When less than $p - 1$ co-integrating vectors are established, the variables are deemed to have partially converged, implying that not all the series in the analysis are converging. If the finding is that there is no co-integrating vector, the analysis concludes that there is no convergence. Several tests were employed to support the findings.

2.3.4 Data Types and Sources

The analysis utilized panel data from WDI for five countries within the EAC (Kenya, Uganda, Tanzania, Burundi, and Rwanda). The panel data comprised the variables presented in Table 2.1. The variables' names and measurement (column1) and a short description of the variable (column 2) and column 3 indicates the data sources.

Table 2.1: Definition of Variables

VARIABLE	Measurement	Source	Hypothesis (expectation)
External reserves	Total reserves comprise holdings of external exchange by central bank in US dollars. Usually measured by value of dollars' worth imports in months,	Word Bank data indicator	Ve+ when convergence increase
National savings	Net transfers plus gross national income less total consumption. Measured in US dollars.	World Bank data indicator	Ve+ when convergence increase
GDP growth rate	"Is the average annual growth rate of real GDP measured by a change in GDP at constant prices as a share of GDP" WDI. Measured in percentage.	World Bank data indicator	Ve+ when convergence increase
Inflation	"The percent change in Consumer Price Index (CPI) on a year-on-year basis." Measured in percentage.	World Bank data indicator	Ve- when convergence increase

2.4. Results and Discussions

2.4.1 Descriptive Statistics

The economies of Burundi, Kenya, Tanzania, Uganda and Rwanda all had relatively high inflation rates between 2008 and 2018. Table 2.2 displays the descriptive statistics for the variables dealt with in this paper.

Table 2.2: Descriptive Statistics

Country	Variable	Obs	Mean	Std. Dev.	Min	Max
Burundi	Inflation	11	9.626581	7.492575	-2.8147	24.40695
	GDP	11	2.641155	2.904747	-3.9	5.124163
	Savings	11	-8.2588	4.18912	-15.6861	-2.06624
	Reserves	11	3.748576	2.117701	0.892541	7.206232
Kenya	Inflation	11	9.182374	6.290076	3.961389	26.23982
	GDP	11	5.148362	2.057241	0.232283	8.405699
	Savings	10	-0.61104	2.506591	-5.40782	2.528295
	Reserves	11	4.048494	0.737186	2.703131	5.245344
Rwanda	Inflation	11	5.031606	4.273718	-0.30953	12.94115
	GDP	11	7.436421	1.82477	4.71983	11.16126
	Savings	9	2.856904	2.640225	-1.01538	5.865374
	Reserves	9	3.831132	0.949216	2.274631	5.696362
Tanzania	Inflation	11	8.262844	3.945212	3.494458	16.00109
	GDP	11	6.203345	0.904821	4.500154	7.672155
	Savings	10	16.32131	2.35689	13.05759	20.30634
	Reserves	11	4.436743	1.011983	3.475476	6.667255
Uganda	Inflation	11	7.631511	4.587878	2.623975	15.12515
	GDP	11	5.732222	1.919882	3.586906	9.391668
	Savings	11	5.824079	4.022489	-0.51152	14.37416
	Reserves	11	4.898788	0.654176	3.9869	6.372568

Source: Author's computation, based on WDI

For these economies, Burundi had an average inflation rate of 9.6%, Kenya had 9.18%, 8.2% for Tanzania, and 7.6% for Uganda. Rwanda had the lowest average inflation rate of 5.0%.

The summary statistics have demonstrated that inflation rate in these economies does not diverge much from each other. Burundi had an average inflation rate of 9.6%, Kenya had 9.18%, Tanzania 8.2%, and Uganda 7.6%, while Rwanda had the lowest, with an average inflation rate of 5.0%. Rwanda's economic performance is strongest among the East Africa economies. The GDP growth rate for Rwanda averaged 7.4%, followed by Tanzania at 6.2%, 5.7% for Uganda, Kenya 5.14% while Burundi recorded the lowest economic performance of 2.6% within the EAC.

2.4.2 Results of Analysis of Macroeconomic Convergence

In this section, sigma convergence was analysed for each macro variable to establish if convergence was occurring. The procedure involved estimating the variation of coefficient, and subsequently analysed its movement over time. Thereafter, Beta convergence was estimated to examine conditional convergence, absolute convergence and the speed with which these macroeconomic variables are converging to the steady state, given their status at the base year and the vector of control variables of interest.

2.4.2.1 Macro-economic variables convergence (Sigma convergence)

The coefficient of variation (σ_t) on the macro-economic variables for all the EACs was estimated. In this case, first, a simple graphical plot of the coefficient of variation was generated to be able to get a visual impression of the trends of the macro-economic variables to assess their status of convergence or divergence. From Figure 2.4, the y-axis is the σ_t, coefficient of variation, which were plotted against the time as provided by Equation 8:
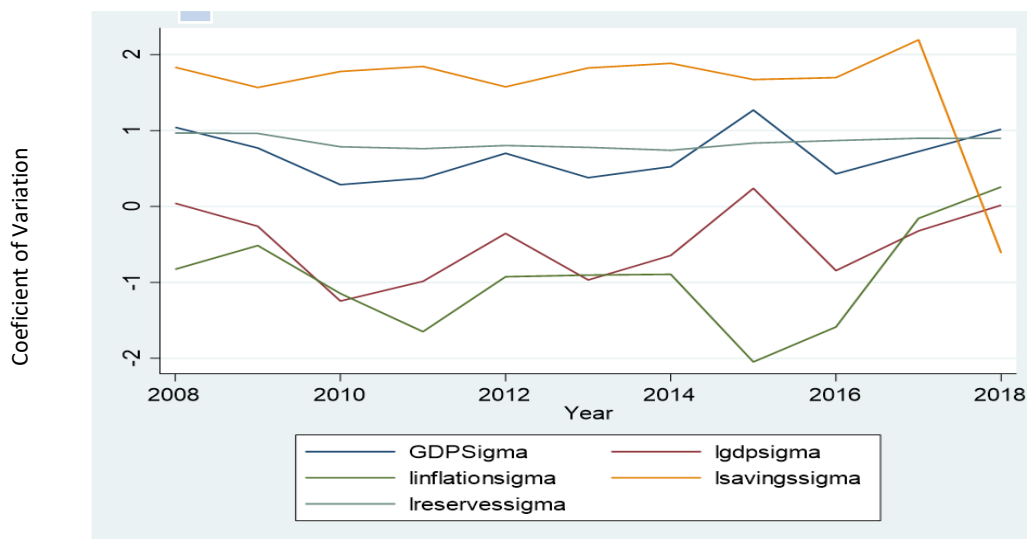
Figure 2.5: The Evolution of Variation Coefficient for all Macro-economic Variables

Source: Author's analysis, based on WDI data

In theory, given a set of countries, the variance (dispersion) δ^2 should be declining over time for convergence to be realized. It demonstrates that the variation in the economic activities of the countries is declining over time and hence the countries are catching up. This is called sigma (σ) convergence among countries. The analysis in Figure 2.4 illustrates a very weak and erratic form of sigma convergence among the EACs macro-economic variables.

The variance of the GDP, inflation, and reserves had mixed trends but mostly rising throughout the period, they exhibited a slight decline from 2008 to 2010 (convergence tendency) then, they either became constant or risen to 2018, meaning divergence. GDP growth rate (gdp) declined from 2008 to 2010 thereafter followed an increasing trend meaning divergence.

Inflation increased 2008 to 2009 (divergence) but thereafter it assumed an erratic pattern which on average seems to be that of divergence than convergence. Savings seemed to be the most erratic macro variable among the EACs. It indicated convergence and divergence periodically; from 2017 to 2018, there seemed to be a sharp tendency to converge. However, given its previous trends, this was less likely to be sustainable. Reserves seemed to have equally erratic pattern similar to savings, diverging to 2009, then convergence to 2011, and same erratic pattern continued, this was also less likely predictable as converging. The movement in Figure 2.4 generally demonstrates erratic form of convergence, mainly dominated by divergence of the variables among the EACs.

To further evaluate sigma (σ) convergence for the EACs macro-economic variables, a regression was conducted for each of the macro variables in line with Equation 2.8.

$$CV = \alpha_0 + \alpha_1 t + \varepsilon_t \qquad (2.12)$$

For this analysis, T=11 years and log σ_t (coefficient of variation) were generated from the data for all the years. The log for sigma σ_t was taken to solve the problem of heteroscedasticity, which we know is inherent in time series data. The sigma-convergence regression analysis results are presented in Table 2.3

Table 2.3: Sigma Convergence Regression Results

	GDP	Inflation	Savings	Reserves
Constant	-55.2680	-88.1890	184.6296	6.0462
Year (time)	0.0272	0.0433	-0.0909	-0.0026
p-value	0.5850	0.5240	0.2160	0.7510

Source: Author's computation using WDI data

The explained variable in the model is the coefficient of variation. According to theory, for convergence to happen, the value of α should be less than zero $(\alpha_1 < 0)$, negative. Therefore, strictly, for convergence, the coefficient of the time variable must be negative to indicate that the variance is declining over time.

From the regression results above, GDP and inflation clearly exhibited divergence although not significant. We take cognizance of the sign of the time coefficient in the regression even though all the tests are insignificant looking at the p-values (greater than 0.05); this result was evident in Figure 2.5 where the lines indicated no clear trend of either convergence or divergence. On the other hand, Savings and Reserves are negative (converging) but they are also not statistically significant, these are also evident in Figure 2.5 above, where they were declining at the initial stages but assumed an upward (diverging) trend thereafter. Hence, described as less sustainable. The only control factor in the model, the per capita gdp has not shown any tendencies to converge at all over time. However, generally it is inferable that there was no convergence for all the macro economic variables tested in this analysis.

2.4.2.2 Beta Convergence and Speed of convergence Regression results

The convergence and the speed of convergence here were estimated following the discussion from Equations 11 in section three. Given that we used panel data, β convergence was estimated using Fixed-Effects Methods, where the control variables (inflation, savings, and reserves) helped to capture the influence of business cycles and other factors on the pace of economic growth. The regression results are presented in Table 2.4:

Table 2.4: Beta Convergence Regressions Results

		Model 1	Model 2	Model 3	Model 4
Constant		-1.5145***	-1.4511***	-1.8436***	-1.9200***
Log y_{it-1}		1.0315***	1.0088***	0.9068***	0.8966***
Inflation		-0.0170	-0.0149	-0.0124	
Savings		0.0137	-0.1460**		
Reserves		-0.1478**			
F-statistics		2.0400*	2.6400**	1.9400	1.8100
R-square	within	0.5062	0.5025	0.4486	0.4420
	Between	0.3062	0.3863	0.3925	0.4111
	Overall	0.3434	0.3861	0.3822	0.3606
B coefficient		-23%	-23%	-22%	-22%

Note: * indicates Significant at 1% level, ** indicates Significant at 5% level, and *** indicates Significant at 10%. Source: Author's computation using WDI data

Given the macro variables for the period, four regression models were estimated where model 1 had all the control variables (Testing for conditional convergence), and thereafter model 2 through 4 each was estimated by eliminating the least significant variables (where the least is 10%) in the previous analysis. Therefore, the last model does not include any control variable to test for absolute convergence using panel data. Since all the coefficients of $log y_{it-1}$ were positive, there is no convergence, following equation 9, for β convergence to be evident, the

values of this coefficient have to be negative for inferable convergence. Therefore, no proof exists of β convergence for the macro-economic variables.

The panel data indicated that countries in the EACs exhibited conditional divergence, also non-convergence in absolute convergence test, as shown in Table 2.4. That is, the annual GDP growth rate had a positive v+e association with the GDP per capita of the year before it (instead of the v-e for convergence) when the macro variables are controlled. The conditional divergence coefficient 1.0315 as seen from model 1 where all the control variables were included (inflation, savings, and reserves). The same was observed with the other models, 2 and 3, including model 4 where testing for the absolute convergence was done. Among the control variables, inflation in this analysis had negative coefficient but not significant implying no convergence. Savings is convergent in model 2 only and significant, but due to the lack of consistency in the other models, it implies a weak form of convergence. Only reserves is negative (only in model 1) and significant, implying convergence.

Generally, since GDP, gdp per capita, and inflation being majority and major, were not convergent, while reserves and savings were also showing a weak form of convergence, we found no reason to test for speed of convergence, because there was no clear convergence trend to call for testing of speed. More so, the F statistics for models 3 and 4 (1.9400 and 1.8100 consecutively), are less than their F critical) meaning, not statistically significant, thus renders the two analyses not to be usable for inference.

2.4.3 Stochastic Convergence

In this section, unit root and co-integration tests were conducted to establish their stability status and behaviour of the time series variables at the then current state and in the long run.

2.4.3.1 Unit-Root Test

In this section, we assumed that the EACs macro-economic variables were individually volatile (they were not stable), that is, they have a unit root. However, we were also keen to establish whether they exhibit a stable relationship in the long-run (co-integration). Therefore, the first stage that is prerequisite for testing co-integration is to establish whether they are stable before analysing the long-run stable relationship. The test statistics here were to explore whether all the variables contain a unit root or whether they were stationary. This test was done to all the macro-variables in this analysis, and the findings are presented in Table 2.5. To achieve robustness, several tests were conducted.

Table 2.5: Unit Root Test for EACs Macro-Economic Variables

unit-root test	Statistic	GDP	Inflation rate	Savings	Reserves
Levin-Lin-Chu	Unadjusted t	-14.8505***	-7.9588***	-5.1087**	-7.0827***
	Adjusted t*	-12.9768***	-4.8355***	-1.7489**	-6.2854***
Harris-Tzavalis	rho	0.1896***	0.0040***	-6.27220***	0.5446**
Breitung unit	lambda	-1.6488**	-0.9583	-1.1877	-0.8415
Im-Pesaran-Shin	t-bar	-3.5472***	-3.5559***	-2.7052**	-1.9657
	t-tilde-bar	-2.2564***	-2.1724***	-1.8024**	-1.5939
	Z-t-tilde-bar	-2.9719***	-2.7139***	-1.5772**	-0.9367
Fisher-type	Inverse chi-squared (10) p	55.8437***	62.9649***	42.109***	16.2644*
	Inverse normal Z	-5.4130***	-5.3104***	-3.0459***	-1.2123
	Inverse logit t (29) L*	-6.8716***	-7.6646***	-4.6086***	-1.1817
	Modified inv. chi-squared Pm	10.2510***	11.8433***	7.1798***	1.4008*
Hadri LM	Z	2.7992***	2.6767***	2.8326***	6.5952***

Recall that the symbols *, **, and *** denote significance at various levels: significant at 1percent, significant at 5 percent, and significant at 10 percent.

Source: Author's computation using WDI data

From Table 2.5, we can see that, almost all the tests were statistically significant revealing that most of the macro-economic variables in our analysis were stationary (stable). However, the test by the Breitung unit demonstrated that only GDP was stationary, and the rest of the macro-economic variables were not stationary.

In addition, looking at reserves the results of half of the tests showed that the variable was non-stationary, supporting the presence of a unit root for this macro variable, but also half of the tests show stationarity. It should be noted here that level of statistical significance majorly supports stationarity.

From the unit root test, we could only run co-integration tests for inflation, savings and reserves, given that one test failed (Breitung unit) and showed that they are not stationary. The stationarity of the macro variables was also evident from Figure 2.4, where the lines were not trending but rather exhibited stationarity. This test did not apply to the GDP because it was already stationary in the entire test and therefore already exhibited hope of long-term (co-integration) convergence in the future.

2.4.3.2 Co-integration Test

Co-integration tests assume that a combination of time series variables may be non-stationary in the near future but may have a long-run equilibrium (stationarity) association later. If variables are co-integrated, we conclude that they are converging in the distance future. The null hypothesis in this analysis were tested to support that there is no co-integration and the alternative hypothesis is that the panels are co-integrated. Several tests were done to make sure

the outcome is robust. Co-integration Test for Macroeconomic Variables are presented on table 2.6.

Table 2.6: Co-integration Test for Macroeconomic Variables

Co-integration test	Statistics	Coefficient	P-value	Significance
Kao test	Modified Dickey-Fuller t	1.1150	0.1324	
	Dickey-Fuller t	-0.4146	0.3392	
	Augmented Dickey-Fuller t	0.3229	0.3734	
	Unadjusted modified Dickey-Fuller t	-4.6938	0.0000	***
	Unadjusted Dickey-Fuller t	-4.9844	0.0000	***
Pedroni test	Modified Phillips-Perron t	1.8759	0.0303	**
	Phillips-Perron t	-2.0276	0.0213	**
	Augmented Dickey-Fuller t	-5.1388	0.0000	***
Westerlund test	Variance ratio	-0.8339	0.2022	

Note: * denotes Significant at the 1% level; **, Significant at the 5% level; *, Significant at the 10% level. Source: Author's computation using WDI data**

From the analysis, we can deduce that most tests are significant indicating that, the macroeconomic variables are co-integrating in the long term. Statistical significance here also supports inference of co-integration in the long-run. Since majority tests were statistically significant, there was sufficient evidence that these macroeconomic variables are stationary and therefore could have a long-term relationship (co-integrating), that is, converging over time in the long run, this raises hope of eventual convergence. From table 2.6 most of the tests are significant at 1percent and 5 percent.

2.5. Conclusion and Policy implication

2.5.1 Summary of Findings

The objective of this chapter was to establish the status of convergence of macroeconomic variables, namely GDP, inflation, savings and reserves, which are largely fiscal in nature. This was done by analysing their trajectory over time. The analysis showed that there is no convergence amongst the EACs macroeconomic variables going by the study's findings. The analysis of macro-economic variables of interest for the five EAC countries do not show convergence in the short run. They nonetheless prominently demonstrated stationarity (stability), though in some instances, erratic patterns emerged. This is a pointer to the effect that the objective of the East African Community (EAC) of forming an economic union, which would, translate to a monetary union, is not being realized soon as intended.

From the sigma convergence test, GDP and inflation clearly exhibited divergence although not significant. On the other hand, Savings and Reserves were negative, that is to say converging,

but they were also not statistically significant. Even from graphical presentation, they were declining at the initial stages but assuming a diverging trend thereafter. The β convergence tests shows that relatively less developed countries like Burundi, Rwanda and Uganda in the EA region are not catching up with the relatively developed nations (Kenya and Tanzania) in regards to economic growth.

The speed with which they are catching up with their peers is negative (shown by the positive coefficients of GDP and GDP per capita values in the Beta convergence tests); meaning their differences are increasing rather than decreasing.

The stochastic convergence tests (co-integration and unit root tests) further supported the conclusion that the macro-economic variables are not co-integrated now but are moving slowly towards the same direction and could indeed be co-integrated only in the future, thus may have a common trend of stationarity only in the future.

2.5.2 Conclusions

Lack of convergence shows that the objective of the East African Community (EAC) of forming an economic union, which would, translate to a monetary union, is not going to be realized soon as intended.

Less developed countries realize less growth and those that are higher in growth are increasingly gaining growth. This somehow disapproves the β convergence theoretical positing, that countries with lesser initial capital should grow faster than those of higher initial capital. This is a further pointer to the fact that the successful realization of an economic union and monetary union in the near future could be a pipe dream.

Co-integration test is however encouraging and indeed shows that there is hope for future stability and convergence. Nonetheless, it also shows that the EACs are individually pursuing their development agendas without exerting efforts to converge soon, likewise that they are not pooling up their macro-economic policies, that is monetary, fiscal and exchange rate policies, in a manner that would result to the realization of an economic union and subsequently a monetary union soon.

2.5.3 Policy implications

The findings above have imperative policy implications for the countries in the EAC region. Looking at the non-convergent GDP growth and inflationary trends, there is a need for coordination of the policies that govern the EAC to the extent that they are geared towards a

uniform growth trajectory for all the member states to achieve common GDP growth and inflationary levels. Establishment of the EA Monetary Institute (EAMI), which will provide coordination role, can achieve these. The policies that affect trade and macro-economic factors should be coherent to the extent that economic actors operate in a certain common and specific environment as they conduct their businesses across the board. The objective of having a stable macro-economic environment should be given more focus if these countries purpose to realize convergence and a MU.

On savings and reserves trends, though having encouraging trends by showing weak convergence, there is need for better management of monetary policies, for instance putting in place inflationary targeting and effective exchange rate policies, improvement of export sector mainly manufacturing sector, while majorly specializing and diversifying, which could significantly contribute to eventual conclusive convergence in savings and reserves.

To achieve convergence, the EACs may come up with robust monitoring and enforcement mechanisms that would deter member countries from deviating from the agreed guidelines. In the monetary union protocol, it is provided for the establishment of surveillance, compliance and enforcement institution. The institution and other guidelines could be a blueprint from which member countries must integrate their macroeconomic policies into their national planning and decision-making frameworks. In addition, the institution will need to be independent from political pressures. This is because the idea of macro-economic convergence is not only to establish free trade area but also to make it sustainable to achieve a deeper integration.

For countries that are less advanced to catch up with the relatively developed countries, the EA community should help the less developed members to realize higher savings, investments and foreign reserves. To be in line with the New growth theories (Endogenous growth) such as those of (Paul Romer & Robert Lucas, 2012) and (Barro & Sala-i-Martin, 1990), the less developed should strive to develop a highly skilled human resource capital, improve adequacy of infrastructure and improve their production and manufacturing capacity so as to achieve the beta convergence.

Response to divergence paths should be mainly based on the implementation of policies that can eliminate the diverging patterns. In short, the member states should enhance implementation of the CU and CM protocols to achieve implementation of the MU. The results obtained validate the role of factors such as heterogeneity of fiscal policies and monetary

policies, but also including trade barriers that inhibit relatively lower income countries to increase their per capita income largely in comparison to the relatively higher income members, thereby widening the income gap across member countries. These policy trends need reversion through improvement of policy homogeneity, openness for flow of capital, labour, goods and service, to achieve positive results.

Finally, they should campaign for equal donor support from development agencies and international community to realize convergence overtime for all member countries. Variance on donor funding can be a factor to variability in growth. This is in addition to the need for macro-economic convergence of the member countries but is a factor that could also speed convergence.

CHAPTER THREE
MONETARY POLICY CONVERGENCE WITHIN THE EAC: A FOCUS ON INTEREST RATE AND EXCHANGE RATE CHANNELS

3.1 Introduction

3.1.1 Introduction and Background

The European integration provided a perfect framework for testing regional integration influence in economic growth. Previous studies such as (Badinger, 2005) suggested a notable favourable effect of integration on growth. Over the previous decades, the global economy has moved faster to adopt economic cooperation agreements in the international trade contract frameworks, leading to the creation of regional economic integration zones. (Sicato & Carvahlo 2018), have defended the emergence of custom unions and free markets as a lever that hastens the globalization phenomenon. They contend that with the principle of macroeconomic convergence emphasis in integration especially for a MU, makes member states better off without leaving others worse off. Alongside that, coordinating economic policies helps a nation to account for spillovers and better achieve national objectives. Thus, macroeconomic convergence is an inevitable overture and a key step towards unified monetary and financial systems in regional integration.

As originated by the Maastricht Treaty 1992, nominal convergence was the main condition of the Eurozone. The fulfilment of the nominal standards was required at the period of accession. Nevertheless, after accession, the nominal standards were no longer strictly enforced. States, according to (Aursulesei & Maha, 2019), preferred to disregard any prerequisites, particularly those they suspected to be political and costly at the expense of national interests. The nations that neglected the majority of the convergence requirements are now the most economically susceptible, according to the report. The financial crisis hit Portugal, Italy, Ireland, Spain, and Greece. Greece was nearly facing Grexit, with the EMU forced to make concessions to rescue the country from insolvency.

In the midst of emphasis of convergence, there are indicative demonstrations that nations, specifically are abandoning inflation and public debt requirements. Notably both the nominal long-term rate of interest and the budgetary shortfalls, and including inflation do move in the same direction, and therefore, in contrast abandoning the two conditions only harms the member countries. For starters, the MU as a whole becomes more vulnerable to financial and other economic crises. Countries with higher levels of public debt become susceptible to potential shocks. Furthermore, because of the shared currency, other subscriber nations become adversely exposed to the shocks and are forced into action to assist the distressed states.

The inability to satisfy the convergence criteria can lead to a severe monetary union catastrophe. Out of all the available evidence it becomes critical that nations should concentrate on pursuit of convergence while also persuading non-participant nations intending to join to embrace the common currency and proceed with the integration process, particularly the convergence requirement. Only a United Europe can become an important global player and a leader in the global economy, (Aursulesei & Maha, 2019) averred.

To promote industrialization, the EAC reaffirms regional financial integration as essential for boosting regional commerce and large-scale operations by combining fragmented markets. Utilizing the financial sector's influence to promote savings, which may in time be used in other areas of the economy, is indeed part of financial integration process. A well-developed financial sector aids in the mobilization of savings, the availability of credit, and the distribution of resources. Investment, capital and equity markets, market centralization, and all other procedures that encourage convergence are good examples of financial market integration and interest rate is one of the important unifying tools. The degree of financial integration can basically measure by the level of interest rate convergence, (Stoica et. al., 2020).

To establish a monetary alliance, associate nations must forgo the capacity to alter their nominal rates of exchange as a national macroeconomic strategy tool and embrace a single

exchange rate approach defined by a supranational bank. A hybrid framework of exchange and interest rates can be used by the regional supranational bank to intervene to accomplish fiscal and monetary goals or it can establish a fixed or floating popular rate of exchange that will offer stability to all monetary union member states especially in cases of international shocks, (Adam et. al., 2016). In this regard, the EAC participating nations appear to be already embracing the hybrid approach.

The past encounters of the EU largely influence the framework. The efficacy of the system depends on the belief that vital relative loans, assets and general pricing is what keeps an economy on a stable and long-term growth trajectory. As a result, the real rate of exchange also becomes a competitiveness gauge. It presents the relative cost of production in terms of the shared currency, since nominally adjusted domestic inflation rates of interest are gauges of the intertemporal balance of overall consumption and overall saving in the economy. Therefore, regulating the nominal rates of exchange between trading partners is a requirement of a monetary policy, and all state parties are subject to the interest rate defined by the supranational bank of the union. As a result, the difference between the nominal interest rate, established at the supranational level, and the local inflation rate, as determined by members' competitiveness, is referred to as the real rate of exchange within the region. Additionally, it implies that the same variables that affect external competitiveness also influence real interest rates and may even have a reverse impact on it. Therefore, monetary convergence is describable as the degree of the impact of interest rates relative to currency rates, (Adam et. al., 2016).

Sound macroeconomic tools in a monetary union are concentrated on utilizing interest rates to stabilize the economy. Alterations to interest rates should be calculatedly be activated as output inconsistency increases, as an outcome of cumulative demand shocks, to maintain the desired inflation rate and production stability. The fiscal policy specifies the composition of public expenditures and ties long-term public debt to a fixed level, whereas monetary strategy

provides lender-of-last-resort liquidity to maintain financial security. This suggests that the responsibility for short-term macroeconomic stabilization rests with monetary policy, (Stoica et. al., 2020).

Notably, actions based on international interest rates would definitely have an impact on the local interest rate. The Solow model, based on an open economy, gives a complete framework in which capital mobility in the foreign market interacts with the growth function of the domestic markets. The extra money in more advanced economies redirects to less advanced states with higher returns. This is to say, excess capital shifts to countries, which have not attained steady state and are still experiencing the diminishing marginal returns on capital.

Although governments can negotiate lower-cost loans on the global market, local banks and local securities are the ones mostly depended upon for funding public investments. However, with convergence, participating countries would be able to get less expensive international credit through a MU, to assist the region's growth and integration. As per (Stoica et al., 2020), the best indicator of banking sector integration in a monetary union is interest rate convergence. When interest rates begin to converge more rapidly, the financial sector become more interconnected. Because it reflects an even distribution of wealth, and convergence becomes a long-term indicator of sustainable growth. The financial system implies more interconnectedness when banks can provide loans across borders, whereas cross-border borrowing implies existence of strong international trade. The increase in bond yield margin affects economic growth negatively, whereas a drop in the interest rate margin positively influences economic expansion. Thus, credit availability is therefore crucial to interregional trade.

Interest rate convergence assessments can aid in determining whether the aims of more financial integration, stronger monetary integration, and the application of a common currency

are realistic. Monetary policy structuring typically revolves around interest rates. Greater integration implies more diversification in the financial industry and, as a result, less reliance on the cyclical cycles of the local economy. A good monetary policy has a significant primary role and a stable interest rate as a transmission channel is even associated with greater financial integration. Although, increased financial integration is sometimes associated with credit crunch during downturns owing to cross-border contagions and systemic risks, but may also help ease credit constraints and reduce loan interest rates, (Fetch et. al., 2012).

Financial convergence assessment is implementable in numerous ways. The assessments can be dependent on aspects such as quantitative and price reports. The quantity-based method addresses cross-border transactions, such as cross-border loans and deposit acceptance, as well as cross-border mergers and acquisitions. However, generally data on quantity-based metrics are scarce and are either inaccessible or unreliable.

To examine convergence in price-based measures the Law of One-price (LOOP) is mostly used. Since interest rates are also alternative measure of the cost of living, when testing for financial sector convergence, the parity criterion is the prerequisite for obtaining interest rate parity, (Aziakopono & Wilson, 2013). The tests look at the rate of interest charged by monetary authorities and the marketplace small-scale banks, to assess the convergence of the banking industry or monetary policy channels.

To promote a secure macroeconomic environment, convergence baselines developed by the EAC for member nations to meet while the area works towards full economic and monetary union, are important. These standards are significant since external shocks in one nation may result in spill-over consequences, undermining the regional monetary policy and have serious negative repercussions on the region's exchange rate and the balance of payments.

The institution of a monetary merger and adaptation of a common currency was one of the key goals of recreating the EAC. The monetary transmission mechanisms among member states ideally must be similar for a monetary union to work. Due to this, the parameters in the monetary policy transmission channels play a crucial role in advancing the process since changes in transmission mechanisms, arising from variations in economic structures, influence the bearing of the real economy, (Mlosa et. al., 2018).

Effective monetary policy, according to (Muwanga, 2016), is a requirement for nations to achieve homogeneity before joining monetary unions, as monetary policy affects the money supply as well as inflation, unemployment, and economic growth hence, the convergence of those variables is required before regional integration may take place. States can use monetary policy measures like the rate of exchange, which may be constant or fixed versus a single currency or a set of currencies. Nevertheless, because EAC member nations do not currently have identical monetary policies, the convergence requirements effectively attracts protracted arguments especially in the case of exchange rate and interest rate targeting. Furthermore, many countries are still working hard to stabilize their exchange rates particularly by struggling to align in the management of the floating exchange rate regime, (Mafusire & Brixiova, 2013).

Formation of a currency union has indeed been the main drive in regional countries striving to achieve macroeconomic convergence; however, this comes with many challenges mostly involving coordination and structural harmonization. Therefore, the EACs endeavours have constantly elicited advice to move cautiously in this journey before finally forming the union; to begin with, they have failed to create a firm common trade area, the CMP, since the endorsement of the agreement 10 years ago. Additionally, inter-regional trade is just 15 percent and given that, only five countries are involved, compared to say 14 of the EMU, the indications are not good. This is a weak foundation; the members utterly rely on exporting unprocessed or unfinished materials, rendering it challenging to meet the requirements of forming the MU.

This is unlike the markets of the industrially developed nations that have formed monetary unions. EAC must therefore first concentrate on the convergence of macroeconomics before forming a currency union to avoid the consequences arising from loss of the influence of using the monetary and the exchange rate channels.

The EAC undertook to establish the monetary union by the year 2012; nonetheless, it is still incumbent upon them to attain stability of the interest rates as well as the exchange rates. These are the major monetary policy transmission mechanism channels depended upon in the region, without fore mostly their stability followed by convergence; the creation of a monetary union would have policy implications that can be biting to the states. It is therefore essential to re-evaluate the magnitude at which the transmission mechanism channels of the EAC monetary policy have stabilized and converged over time, especially since the signing of the monetary union foundational instruments in 2010, and if they have any remarkable influence on the desired macroeconomic achievements especially those pertaining to sound economic growth.

3.1.2 Statement of the Problem

The EAC formulation projected a trajectory that would culminate into a monetary union at the end, however, before a member country joins a monetary union, they have to attain the set minimum criteria and relinquish the control that they have over monetary instruments. The monetary policies do affect the markets through specific transmission channels two of which the monetary committee of the East African community adopted as threshold variables towards formation of a MU. They are mainly the exchange and interest rate channels. Establishing whether these variables are stable and have a long-run convergence trends or not is critical as this will guide the monetary committees on the appropriate actions of adoption to achieve the desired goals. Failure to attain the intended currency union would mean that the member states will not enjoy the benefits of economies of scale in production and expanded markets for their produce enhanced by expectations of the free trade zoning in the region. This prompts inquiries

into the likely reasons why the EAC has failed to achieve the intended targets. There is a need to investigate the trends and the directional tendencies of the variables to support or reject any alluded causalities or if the member states are just not willing to implement policies that would promote the union.

According to monetarists, monetary policies are more effective than fiscal policies if the governments want to realize quicker adjustments in the economy. They are indeed the drivers of the economies to the extent that their manipulations determine the rate of economic growth and eventual convergence of the fiscal macro-variables, which are also of major concern in this thesis. Therefore, the two variables, interest rates and the exchange rate which are the monetary transmission mechanism channels that are depended upon by the EAMC need to be reviewed and analysed to establish if their instability and non-convergence are the likely reasons why the utmost goal of creating a MU in the EAC has not been attained to date.

3.1.3 The Research Objectives

The overall goal was to analyse the convergence and stability of monetary policy transmission channels with exchange rates and interest rates being the focal channels.

i.   To test the stability of interest rates and exchange rates within the EAC

ii. To establish presence of convergence trends of interest rates and exchange rates within the EAC

iii. To determine the impact of interest rates and exchange rates on GDP growth rate within the EAC.

3.1.4 Organization of this chapter

The remainder of this chapter has four segments. Section 3.2 describes the review of the literature while section 3.3 focuses on the discussion of the methodology and empirical models employed in the study. Segment 3.4 presents the results while the final section 3.5 concentrates on the study summary of findings, conclusion and policy implications.

3.2 Literature Review

3.2.1 Theoretical Literature

3.2.1.1 Interest Rate Channel as à MPTM

In summary, the interest rates channel is generally categorised as originating from the conventional Keynesian IS-LM paradigm. Ever since the beginning of macroeconomic theory, monetary policymakers primarily used rates of interest to influence the economy's money circulation. In a scenario where the total demand for money is reliant on revenue and short-term bond yields, the monetary schemes effect on the short-run rate of interest would begin with steady money demand. The central bank may alter the amount of money available in this situation to influence interest rates. When the central bank expands the amount of money in circulation, short-term interest rates decreases perhaps as intended.

Additionally, for instance an expansionary monetary approach by the central banks could cause a substantial fall in interest. Thus, investment increases as capital cost decrease. Consequently, this boosts overall demand resulting in higher output. Real interest changes solely influence the individual economic units' ultimate spending decisions; however, financial policymakers can only exert influence on nominal interest only in the short run. There is a strongly relationship between real interest rate and the monetary base, which substantially affects the interest rate channel effectiveness. As a result, such monetary schemes are only significant in the short run, with prices eventually adjusting in the long term. Conversely, the theory of rational expectations of the structures of the short-term interest rates claims that the real interest rates, in the long-run, depends on expectations of forthcoming real interest rates in the short run. Policies that take into consideration the impact of short-run policies of the long-term lending rates through sticky prices can thus have an impact on the real economy (Li & Wu, 2015). Besides, such policies also influencing economies of its trading partners through impacts on exchange rate vide movement of capital, (Robert Mundell, 1962).

3.2.1.2 Exchange Rate Channel as a MPTM

Crucially, it is important to consider the rate of exchange, when examining monetary policy transmission mechanisms. Changes in monetary strategies have an impact on currency rates, resulting in changes in net exports. (Robert Mundell, 1962) proved the link between currency rates and interest rates in the short term by arguing that the mobility of capital in the international financial market demonstrates it. Additionally, he said that the disparity in rates of interest between two trading nations equals the predicted rate of exchange between the two nations, according to the interest rate parity relationship. This is because states with the highest returns dominate capital until the returns in various nations equalize. The interest rate parity connection must exist for capital to flow freely across countries.

In open, small economies, the channel of conversion rate is the most essential monetary transmission channel. Contextually, the Uncovered Interest Rate Parity (UIP) theory would have a major impact on the likelihood at which variations in monetary policy influence the volatility of the exchange rate. Future nominal exchange rate fluctuations indeed links to differentials in interest rates in domestic and foreign markets, according to the theory. This data assists the country's central bank in manipulating exchange rates, resulting in variations in the relative prices of commodities in trading countries and, as a result, altering trade volume.

To put this into context, if monetary policy is expansionary, rates of interest will decline, making local investments less tempting. This would lower demand for home currency, causing it to weaken, apart from making domestic goods more competitive than foreign goods, it increases overall productivity and, as a result increase net export. Therefore, the UIP condition has a major impact on the channel effect of the conversion rate. Researchers have however pointed out problems in this theory, recommending its use with a risk premium term. The risk premium term refers to the guarantee that foreign investors require safeguard against currency depreciation and the dangers associated with investing abroad, (Robert Mundell (1962).

As per (Dornbusch, 1976), the convergence pace of real exchange rates in free market economies has connection to stickiness of pricing. In reality, the "purchasing power parity puzzle" refers to the observation that actual rates of exchange appear to converge much quicker compared to nominal prices. According to New Keynesian models, the persistence of sticky prices is irrelevant if rates of interest are not smoothened. The rate of interest smoothing parameter and the likelihood of companies not adjusting pricing under Calvo pricing influence, the capability of the internal rate of real exchange can remain steady for a considerable length of time, (Engel et. al., 2019). Stability of real exchange rate is indeed part of our concern in this thesis.

The currency conversion rate overshooting theory can also describe volatility of the conversion rates. According to (Feuerriegel et al., 2016), the Dornbusch Model indicates that when looking at market dynamics, short-run fluctuations in decreasing or increasing values are greater than long-run fluctuations, culminating in overshooting of the rate of exchange. This means that as market fundamentals shift, currency rates will move faster, (Carbaugh, 2015). Exchange rate overshooting is more likely in models where market adjustment takes time. The overshooting of interest rates in models with gradual price adjustments, on the other hand, will be due to little variations in commodities' prices, with time. When the rate of exchange is uneven, the possibility of being exceeding is significant.

The credence on the OCA zones has had use in most empirical research that attempts to assess nations' readiness to enter a shared currency. (Mundell, 1961), (McKinnon, 1963), and (Kenen, 1969) proposed the concept. The concept anchors estimation of the costs and merits of a monetary union. As per the argument, to reap more rewards, it is mandatory for participating nations of a monetary union to have similar policies and institutions. As a result, the OCA theory provides a base to develop convergence criteria that member states must adopt for a MU formation. These requirements are mandatory conditions for joining a monetary union.

Convergence, stamps out transaction costs and exchange rate volatility connected with currency trading (UNECA, 2018). In this sense, the focus of this chapter is on the stability and convergence tests used to determine the EAC's convergence trends, concerning exchange rates and interest rates.

3.2.2 Empirical Literature
3.2.2.1 Interest Rate Convergence

The European Union has conducted the majority of studies on interest rate convergence and monetary integrations. However, there are also major studies in Africa, Asia and within the EAC and quite a number show the significance of interest rate in monetary spheres.

The parity of real interest rates in the EU was explored by (Arghyrou et. al., 2009). The parity of real interest rates in the EU was explored by (Arghyrou et. al., 2009). The researchers wanted to determine how bond yields changed structural breaks, and how rates of interest influenced the EMU. The variables for ex-post real interest rates were defined in the same way that inflation and nominal interest rates were. From 1996 to 2005, the data was collected every month. The Wald-bootstrap technique was used to simulate the usual ADF unit root tests, where heteroscedasticity and normality were compensated for. The data revealed that interest rates within the EMU quickly converged before 1999, with some countries afterward suffering divergence. Furthermore, by the end of 2005, the bulk of the new European Union nations had reached convergence equivalent to the EMU average. Despite structural discontinuities, there was convergence in real interest parity (RIP) across the EU.

(Jenkins & Madzharova, 2008) looked into the euro's interest rate convergence. To analyse the evolution of real and nominal interest rates in the European Union region, the researchers used co-integration experiments. While it was discovered that nominal interest rates were co-integrated, real interest rates were not. Given the presumption that the adoption of the euro by open EU economies would lead to real interest parity, these results were unanticipated. Also

given the limited amount of period covered by the Euro data, the weak bilateral co-integration tests may account for the discrepancy in the results from the assumptions.

According to (Ilut & Chirlesan 2012), interest rate convergence is quantified by the convergence of both sigma and beta. Sigma convergence[7] is an indicator of banking interconnection that assumes that the more integrated the banking markets are, the higher the convergence rate and productivity. A study by SADC similarly employing interest rate data and demonstrated monetary interest rate convergence as well as banking market convergence, with the latter prevailing, showing the prospect of selective expansion of the CMA.

In looking at interest rates as a monetary instrument, it is important to also check the influence it has on GDP growth and other variables as this would help shade light on its significance in the overall shaping of convergence of other macro variables. In this respect, (Ogawa, Sterken, and Tokotsu, 2016) tested if there was a causal relationship between public debt, economic growth, and real interest rate in the European Union and the OECD region. The sample consisted of 27 EU and 4 OECD countries (United States, Canada, Australia, and Japan), with the data covering the 1995 to 2013 period. These 31 countries chosen were stable democracy and share common goals of transparency in fiscal and monetary policy. The estimation of the results employed a panel vector autoregression (VAR) model. The findings indicated that longterm interest rates were involved in the transmission of shock in economic growth to public-debt for high-public-debt countries. In these high-debt-economies, there was a direct effect of economic growth on public debt because of long-term real interest rate, which decreased interest-sensitive demand and increased public debt to GDP ratio (Kazuo, Sterken, & Tokutsu, 2016).

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[7] Cross-sectional dispersion measured by sigma convergence procedures, measures reduction or increase of that dispersion. On the other hand, the rate of convergence, that is, a reduction rate of the dispersion or convergence is measured by beta convergence procedures.

(Harswari & Hamza, 2017) carried out a study to investigate the impact of interest rates on economic development in 20 Asian countries, a convenience sample selected from the 48 Asian countries. The data covered the 2006-2015 period. Regression was used to establish the relationship between the variables. The study showed that there was a positive and significant relationship between interest rate and GDP growth at p=0.048, (Harswari & Hamza, 2017).

Mishra, Montiel & Sengupta (2002) studied the effects of bank lending means of transmission in India by using the structural VAR methodology applied on monthly data as of April 2001- December 2014 in India. By disaggregating the effects of monetary policy programme via bank lending means into two steps, the study found statistically significant effects of positive shocks to policy rates on the bank lending rates as predicted by theory. In particular, Mishra, et al., 2002) observe that tightening policy is linked to the raised bank lending rates, which is stable with the first step of transmission in the bank lending means. The study, however, indicates that despite the existence of the through-pass from policy rates to bank lending being in the precise course as predicted by theory, the pass-through is incomplete. Specifically, (Mishra, et al., 2016) notes that there exists no evidence of the pass through on the next step indicating no leverage for the impact of monetary transmission on total demand in India. Further, the study also studied the exchange rate means of monetary policy and found that the reaction of exchange rate to the policy disturbances, although is in the correct-course, the size of the effect is very minimal.

(Ahmed, Khan & Bashir, 2018) used a state of the art maximum entropy bootstrap approach in investigating the causal link between the interest rate and economic growth in Pakistan. As opposed to the use of traditional asymptotic theory that are grounded on economic approaches that test for possible unit-root and cointegration, this approach does not require data transformation and retains data characteristics such as trends and structural breaks while providing a robust understanding of the causal link between interest rate and economic growth

rate. The simulation-based maximum entropy bootstrap approach (Meboot) does not require stationarity of variables. The researchers used data from Pakistan, covering the duration stretching from 1960 to 2017, drawn from State Bank of Pakistan, International Monetary Fund (IMF) and International Financial Statistics, and World Bank's World Development Indicators. The findings indicated the existence of a unidirectional causality that runs from GDP growth to short-term interest rate.

(Maiga, 2017) investigated the impact of interest rate on economic growth in Nigeria. The researcher noted that even though Nigeria implemented economic reforms in the 1980s that spurred significant economic development, there remains many problems, particularly the devastating impact of high interest rates on the cost of borrowing and investment in the country. Using ordinary least squares (OLS) regression method, and data (1990 to 2013 period) drawn from the Central Bank of Nigeria statistical bulletins, the analysis indicated that interest rates had a slight impact on GDP growth; however, increased growth could be achieved by lowering interest rates which exerts a positive effect on investment. A unit increase in investment was associated with a 0.057% increase in GDP growth (Maiga, 2017).

(Toroitich & Anyango, 2017), investigated the effects of interest rates stability on the economic performance in Kenya. The researcher noted that Kenya has continually struggled with a widening budget deficit. Even though interest rates had greatly fluctuated throughout the year, its effects on economic growth had not been consistent. The data obtained from the Central Bank of Kenya, Kenya Bureau of Statistics, covering 2005 to 2014 period backed the analysis. The data was analyzed using correlation and regression analysis, and the findings showed that there was a positive and significant relationship between purchasing power parity and economic growth.

(Bosco & Emerence, 2016) sought to determine the effect of interest rates on private investment behaviour in Rwanda, using data covering the 1995-2009 period. The econometric analysis model chosen was based on co-integration and Error Correction Model (ECM). The findings showed that GDP growth has a significant effect on private investment in the short-run and long-run, and that the effect of interest rates was more pronounced in the short-run. In the short-run, a 1% increase in GDP leads to a 5.87% increase in private investment and a 1% increase in real interest rates led to a 0.2% increase in private investment. GDP not only exerts a positive influence on private investment, but private investment is in itself a contributing factor to real GDP growth. The findings that increased interest rates positively affects investment growth, and by extension GDP, growth supports the McKinnon-Shaw hypothesis (Bosco & Emerence, 2016).

3.2.2.2 Exchange Rate Convergence

Convergence is required for the establishment of regional cohesiveness in the context of regional integration. Economic integration driven by similar policy formulation approaches aim to alleviate the restrictions of asymmetry shocks or poor performance in economic metrics, (Masalila, 2009). By minimizing exchange rate unpredictability and transaction costs, assuring monetary stability concerning price and lower interest, and developing self-control among participants to avoid immoderate budgetary shortfalls; macroeconomic policy convergence will promote efficiency and growth.

The exchange rate scheme of different countries differs. Countries that want to join a monetary union must consequently coordinate their monetary policy management, (Muwanga, 2016). (Drummond et. al., 2014) posited that managed floats used in the EAC's three largest economies: Kenya, Tanzania, and Uganda. Kenya and Uganda had completely open capital accounts and controlled floats. Equally, Tanzania has managed floats, but capital account limitations remain in place. The remaining restrictions expect lifting as the liberalization

process continues. Rwanda and Burundi, the other two members, are also on the path of full liberalization. The region's financial market becomes more adaptable in deciding the exchange rate after the three major economies constructed a set of guidelines for exchange rate policy that all central banks should embrace, signalling favourable convergence movements.

As a result, while studies suggest that EAC member countries are implementing convergence techniques, on concerns such as interbank exchange rates, capital investment controls, and exchange rate flexibility, but these are yet to be addressed. Kenya, Uganda, and Tanzania share similar operating processes for currency rate management, whereby they have resolved to maintain adjustable currency rates decided through interbank foreign exchange trading. Additionally, they promised to implement efforts for reserve coverage and liquidity management to control their foreign exchange structure. On the other side, the EACs' inconsistent approaches to managing currency rates are a factor in the foreign exchange markets' apparently unfavourable traits, (Drummond et. al., 2014). A number of research shade light on the EAC region's currency rate administration practices and how exchange rate uncertainty affects other macroeconomic factors.

In randomly selected European countries, (Korkmaz, 2016) used annual data, from 2002 to 2011. The European countries were Germany, United Kingdom, France, Italy, Spain, Poland, Greece, Hungary, and Turkey. The data was obtained from the World Bank and OECD database. Panel data analysis was preferred with Eviews 7.0 used to make forecasts. Panel unit root tests, cointegration, and Granger causality test were used in the analysis. The results show that foreign exchange rates affects economic variables, but the economic factors which included inflation, money supply, and unemployment were not being affected by exchange rates as a result of political decisions, (Korkmaz, 2016).

In China, using the cointegrated VAR model to test the relationship between real exchange rate and economic growth, data was drawn from the period January 2014 to December 2012. The variables selected for the study were nominal exchange rate, nominal GDP, and Consumer Price Index (CPI), foreign exchange reserves, imports and exports, and foreign direct investment (FDI). The researchers used the dynamic RER equation, which was transformed from the equilibrium exchange rate equation and the exchange rates fundamentals equation. As is typical, Augmented Dickey Fuller (ADF) was used for unit root testing and cointergrated VAR (CVAR) model used to analyze the relationship between real exchange rate and economic growth in China. The results demonstrated that there was no direct connection between RER and real GDP in the long run. Exports had a positive effect on RER, while imports had a negative effect on RER. A 1% increase in exports led to a 6.549% increase in RER (devaluation). FDI has a consistent positive effect on the economy. In the short run, policy reform had positive effects on economic growth, (Tang, 2015).

A study by (Khondker, Bidisha & Razzaque, 2012) observed that in July 2012, Bangladesh ended the almost 15-taka rise in dollar price, giving rise to the question of whether the depreciation of the taka would boost export competitiveness, attract remittances and discourage imports, or whether such a rise would cause inflationary pressures. The researchers estimated the empirical relationship by using time series data. The Augmented Dickey Fuller (ADF) test was used to assess time series properties and cointegration and error correction modelling was used to establish both the short-run and long-run relationships. The findings showed that despite the steady rise in the nominal exchange rate, the real exchange rate hardly changed since the 1980s, with the 10% rise in the taka value of dollar only raising RER by 3.2%. Further, the real exchange rate affected overall output and the long-run effects of real devaluations was found to be positive, in that a 10% depreciation in taka was associated with a 2.4% to 2.8%

increase in GDP. On the contrary, in the short run, a 10% real devaluation was contractionary, leading to 0.5% decline in GDP (Khondker, Bidisha, & Razzaque, 2012).

According to (Jandoo & Gonpot, 2018), the majority of advanced economies have a floating exchange rate system because exchange rates influence a nation's relative level of commerce and pricing competitiveness on the international market. The exchange rates are usually denominated in US dollars. (Jandoo & Gonpot, 2018) looked at 14 African currencies denominating their currencies in dollars to determine the apt models to use in determining a common Value at Risk (VaR) model for the 14 currencies. The descriptive results indicated key characteristics shared by all currencies. The three models evaluated were GARCH, GJR-GARCH, and FIGARCH, to determine volatility using the Skew-t, GED, Student-t, and normal distributions. The outcome showed that unconditional Extreme Value Theory (EVT) over-predicts the VAR and that using dynamic EVT for estimation is ineffective. The GJR-GARCH giving (38.5percent) and GARCH (33.3 percent), the models provide superior estimates, although the GJR-GARCH model is the most popular (Jandoo & Gonpot, 2018).

It is also interesting to see how trade balances in Sub-Saharan Africa are affected by real exchange rates and exchange rate volatility. Using data from 14 African countries between 2006 and 2016, the GMM was used to ascertain how real exchange rate fluctuations caused exchange rate volatility. According to the GARCH study, the real exchange rate and exchange rate volatility have had a favourable and considerable impact on the sub-Saharan trade balance, (Olomola & Dada, 2017).

The goal of a study by (Nathaniel & Oladiran, 2019) that used data from 1980 to 2015 to sample from the ECOWAS was to see if exchange rate regimes influence economic integration. Exchange rates, tariffs, linguistic similarity, transportation costs, per capita income, real GDP, and trade openness were all used as indicators of economic integration. Panel data and the FEM

were employed. They discovered that raising the exchange rate system by one-unit results in a 0.13 percent increase in ECOWAS economic integration, indicating the importance of exchange rate regimes for ECOWAS integration.

(Muwanga, 2016) used the bivariate co-integration approach, which is permitted, to analyse the convergence of exchange rates within the EAC. He performed the Sup LM test to see if structural breaks were present. He discovered that convergence had been realized to a negligible degree. These findings indicate that the EAC still has work to do to achieve monetary unity. Another study, which tried to evaluate conditional correlations between daily returns of five EAC currencies tied to the US dollar, discovered strong connections in the member states' exchange rates, (Shiferaw, 2019).

In another case, (Buffie et al., 2018) looked into the synchronization of monetary and exchange strategies in the EAC. For both internal and international equities, the researchers utilized a two-factor model with imprecise substitution. The results revealed that stringent currency rate regulation, aids in meeting inflation goals. Findings demonstrated that while concentrating on a flexible exchange rate system, inflation targeting had a significant probability of being indeterminate. Moreover, it was discovered that little inflation shocks surge inflation ex-post. By stabilizing the nominal exchange rate or taking steps to enhance the propensity towards a controlled float, both problems can be resolved, (Buffie, Airaudo & Zanna, 2018).

Since monetary policy transmission mechanisms are part of the protocol desired for the monetary union, (Mlosa et. al., 2018) assessed how well the EAC's exchange rates, money supply, and credit functioned as conveyance mechanisms. They observed that the money supply channel had a favourable and enormous influence on the actual economy using panel data for five EA states over 22 years. It serves as a crucial conduit for the dissemination of

EAC's monetary schemes as a result. On the other hand, the rate of currency and credit channels had little to no influence on the dissemination of the monetary approach.

In a study carried out on the effect of foreign exchange rate volatility on export trade, the researcher used data from the Central Bank of Kenya, covering the period 2011 to 2015. The data captured monthly inflation prices and monthly foreign direct investment as a percentage of GDP. Using multiple linear regression, the findings established that a positive and significant effect of average exchange rate on monthly FDI as a percentage of GDP, with a 1 unit increase in exchange rate leading to an increase in FDI as a percentage of GDP by 7.8%, (Akwabi, 2018).

Another study sought to establish the effect of macro-economic variables on exchange rates in Kenya, using an explanatory research design to establish the causal relationship. The data covered the 2000 to 2016 period, and the Classical Linear Regression Model (CLRM) was used to test for violations of stationarity assumptions. Analysis using a multiple regression method showed that there was a positive but insignificant relationship between interest rate and exchange rate; a negative but insignificant relationship between inflation and exchange rate; while there was a positive and significant relationship between GDP and exchange rate (Moheddin, 2018).

Not all studies in Kenya have reported a positive and significant relationship between exchange rates and GDP growth. Further, one of the difficulties in establishing the link between exchange rate and GDP growth is that the mechanisms underlying their interactions are indirect. However, it is crucial, when doing this to focus, on the interactions between the local price of foreign exchange (exchange rate), the change in domestic prices (inflation) and the change in real income (GDP growth). In addition, it is also important to recognize the effect of high inflation rate typically caused by widening budget deficits, within the context of a sluggishly

adjusting nominal exchange rate that is artificially managed by the Central Banks in order to achieve price stability. The net result is real over-valuation of exchange rate, which can pose a negative effect on export growth and create uncertainties in the future movements of exchange rate (McPherson & Rakovski, 1998). A case in point is a study which used three models to establish the relationship, notably: within the context of a fully specialized macroeconomic model, as a single-equation instrumental variable estimation, and as a vector autoregression model. The study covered the 1970 to 1996 period. In all the three cases, the study found out that there is no evidence of a strong direct relationship between changes in exchange rate and GDP growth. On the contrary, the rate of economic growth is greatly influenced by fiscal and monetary policies, availability of foreign aid, and export growth (McPherson & Rakovski, 1998). In a much larger study of 150 countries, it was also established that exchange rates have no effect on developing countries (Habib, 2016).

(Kiptui & Ndirangu, 2015) examined the real exchange rate misalignment in Kenya. They utilized data covering the 2000 to 2014 period. The Behavioral Equilibrium Exchange Rate (BEER) approach was adopted to establish the degree of exchange rate misalignment. Quarterly data was pulled from Central Bank, IMF and World Bank. The Augmented Dickey Fuller and Phillips-Perron tests were used to test for stationarity, with cointegration vector auto-regression model used to examine misalignments. Results showed that misalignments occurred for most of the study period and lay within the 10% deviation from equilibrium. One explanation for these misalignments were as a result of global developments such as the global financial crisis and the euro crisis. Further, the results also showed exchange rate overvaluation between 2006 and 2008 and between 2011 and 2013, a minor overvaluation in the last quarter of 2014. These findings imply that Kenya was running a managed float regime, hence the exchange rate keep adjusting to changing economic fundamentals (Kiptui & Ndirangu, 2015).

In a different study, observing the substantial exchange rate volatility as a result of the adoption of the floating exchange rate, (Mwangi, 2015) carried out a study to determine the effect of exchange rate on French beans exports. The data covered the 1990 and 2011 period. The generalized autoregressive conditional heteroscedasticity (GARCH) model was used to measure exchange rate stability. The findings reported indicate that the exchange rate volatility exerts a negative effect on French bean exports, despite the fact that the increase in the level of income in EU market increased the volume of exports from Kenya, while the increase in price is associated with decreased demand of French beans exports to the European Union (Mwangi, 2015). In the same vein, (Oude, 2013) reported that exchange rate fluctuations had significant adverse effects on GDP, and led to contraction of growth, demand for investments and exports. However, in this study, the model did not decompose GDP as a function of exchange rate (Oude, 2013).

3.2.2.3. Literature Overview

Existing studies on the convergence of currency rates and interest rates have shown conflicting conclusions. Comparing the data is difficult because of variations in scientific techniques that establish the sample period (monthly, quarterly and annual data). Most of the reviewed studies majorly concentrated on causality relationships especially for the interest rate strand. However, the studies shade quite some light on the significance of the interest rate component. To understand how the EACs are acting as the East African region evolves towards a full common trade area and, ultimately, a currency union, this study concentrated on the convergence of the two key variables in the transmission of monetary policy, namely, interest rates and exchange rates. Previous analysis largely focussed on individual variables convergence using time-series data but this analysis used panel data to gain on robustness of more details available in using the panel data. For the transmission mechanisms of interest, the analysis checked for stationarity, co-integration using multiple tests.

3.3 Methodology

3.3.1 Testing for Stability

A reasonable test to determine if the time series data are stationary (stable) is to look for unit roots. The equation 3.1 was used to test for unit roots.

$$x_t = \mu + \beta t + \varphi x_{t-1} + \sum_{i=1}^{k} e_i \Delta x_{t-1} \qquad (3.1)$$

In the equation, X represents the series of macroeconomic variables (such as interest rates or exchange rates); t stands for time and k is for lag order. It is assumed that each series has a non-zero mean and non-zero drift since the model includes a constant and a trend factor. The alternative hypothesis for this model is $|\varphi| < 1$, and the null hypothesis is $|\varphi| = 1$ if the null hypothesis is not rejected, then the variable is termed as non-stationary.

3.3.2 Testing for Convergence

To inspect for the existence of convergence of interest rate and exchange rates in the EAC, the analysis examines sigma and Beta convergence, and eventually performs a co-integration test to understand if the variables are associated in the long run.

3.3.3 Sigma (σ) Convergence

Sigma convergence exists when the differentiation of the macroeconomic variables decreases over time. By calculating their standard deviation, one may determine the macroeconomic variable's dispersion (variation). This is also known as the macroeconomic variables' coefficient of variation (CV). For all EACs, this study examines the CV's interest and exchange rates. The CV is calculated using the following formula;

$$CV = \frac{standard\ deviation}{mean} \qquad (3.2)$$

The CV was graphed against time to highlight the direction in the sigma coefficient

progression.

$$CV(y_t) = \alpha_0 + \alpha_1 t + \varepsilon_t \qquad (3.3)$$

 The period covered by the research is a predictor variable, and the predicted variable is the coefficient of variation for the macroeconomic variable for the EACs (2008-2018). The time variable's (α_1) coefficient should be negative according to the principle for examining convergence.

3.3.4 Co-integration Test

The long-term link between the borrowing rate and the rate of exchange for EACs will be investigated using several co-integration experiments. Writing the model's exact expression:

$$\Delta V_t = \emptyset + \Omega V_{t-1} + \sum_{j=1}^{k-1} \bar{O}_j V_{t-j} + m_t \qquad (3.4)$$

V_t in the equation above indicates a vector of interest rate and exchange rate variables and $\Omega = \varphi\beta$. The emblem φ, stands for the adjustment matrix speed and β represents the cointegration matrix, r<n. when performing hypothesis testing, maximum eigenvalue statistics and trace statistics can be calculated.

When the difference between two series, xi and xj becomes unpredictably tiny over time, convergence has occurred i.e.

$$\lim_{n \to \infty} (x_{it} - x_{jt}) = \varphi \qquad (3.5)$$

It is established that, for random series, convergence necessitates that the anticipated value of the difference between the two series decrease randomly over time, that is:

$$E\left\{ \lim_{n \to \infty} (x_{it} - x_{jt}) \right\} = \varphi \qquad (3.6)$$

Convergence occurs after the difference between the two X series is integrated to a lower order than the starting series. This implies that if each X series is non-stationary, the difference between the two series ought to be stationary.

3.3.5 Testing for the Impact of Interest Rates and Exchange Rates on GDP

Assessing the effects of the two monetary aggregates on the GDP is done using equation (3.7).

$$y_{it} = \alpha_i + x'_{it}\beta + u_{it} \qquad\qquad (3.7)$$

Where the explained variable (y_{it}) if it is a time-variant, the explanatory variables are elucidated by the matrix (x'_{it}), and the specification α_i and u_{it} classify the model as to whether it is a pooled OLS, fixed or random effect models, and within effect model.

The Hausman test and Breusch-Pagan Lagrange Multiplier test should be used to choose the suitable model to use after analysis.

3.3.6 Definition of Variables and Data Sources

This segment provides a synopsis of the panel data employed in the study.

Table 3.1: Definition of Variables

Variable	Data Description	Source
The real interest rate	the GDP deflator[8] was used to modify the interest rate charged on loans for inflation. Measured by percentage.	WBI
Real effective exchange rate	Given by dividing a price deflator/cost index by the nominal effective exchange rate. Measured by percentage.	WBI
GDP growth rate	"Is the average annual growth rate of real GDP measured by the change in GDP at constant prices as a share of GDP" WDI. Measured in percentage.	WBI
Inflation	"The percent change in Consumer Price Index (CPI) on a year-on-year basis". Measured in percentage.	WBI

Source: Authors data description

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[8] Using the GDP price deflator helps economists compare the levels of real economic activity from one year to the other. The GDP price deflator is a more comprehensive inflation measure than the consumer price index (CPI) because it is not on a fixed basket of goods.

3.4 Empirical results and Discussion

This segment conveys an analysis of the data, presentation of the resulting outcome, and subsequent discussion. In the first part, descriptive statistics of the data are presented and thereafter regression results are analysed.

3.4.1 Empirical Results
3.4.1.1 Descriptive Statistics

In Table 3.2, the descriptive statistics for the data used in this investigation are displayed. Respective national authorities give the exchange rates, and they are legally sanctioned by foreign exchange markets. The data are derived by getting the yearly average, based on monthly averages (expressed in local currency units relative to the U.S dollars).

Table 3.2: Descriptive Statistics

Country	Variable	Obs.	Mean	Std. Dev.	Min	Max
Burundi	GDP	11	2.6412	2.7696	(3.9000)	5.1242
	Exchange rates	11	0.0007	0.0001	0.0006	0.0009
	Interest rates	11	4.6380	6.8934	(6.1948)	18.1577
Kenya	GDP	11	1.3870	1.9615	0.2323	8.4057
	Exchange rates	11	0.0010	0.0012	0.0097	0.0131
	Interest rates	11	3.6725	4.0884	(0.9850)	12.0282
Tanzania	GDP	11	0.7192	0.8627	4.5002	7.6722
	Exchange rates	11	0.0001	0.0001	0.0004	0.0008
	Interest rates	11	3.3709	4.1895	(1.2018)	14.5233
Uganda	GDP	11	1.4773	1.8305	3.5869	9.3917
	Exchange rates	11	0.0001	0.0001	0.0003	0.0005
	Interest rates	11	6.1980	8.2357	(9.7494)	19.5382
Rwanda	GDP	11	1.4643	1.7398	4.7198	11.1613
	Exchange rates	11	0.0002	0.0003	0.0012	0.0021
	Interest rates	11	3.4273	4.3887	1.7184	17.8812

Source: Author's computation from WDI data

On average, Kenya has the highest exchange rate (0.001 %), that is, the strongest, followed by Burundi (0.0007%), Rwanda (0.0002%), Tanzania (0.0001%) and Uganda (0.0001%) had the least average exchange rate. The exchange rates show the strength of the respective local currencies against the US dollar. It is also a simple indicator of the robustness of the economy

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in question against that of a pegged developed country, in this case the US. It is noteworthy that within the EACs, Kenya has the largest economy relative to the other nations.

Conversely, the average interest rate is highest in Uganda at 6.2%, that is the most expensive loaning rate, followed by Burundi at 4.6%, Kenya at 3.67%, Rwanda at 3.4%, and finally Tanzania at 3.37%, having the best loaning rate. The average interest rate level serves as a gauge of the financial deepening of a nation, meaning that a country with lower interest rates offers a higher level of access to financing facilities than the ones where the interest rates are higher.

Table 3.3 provides the Descriptive Statistics for the Panel Data obtained. It is crucial to consider the panel data variables' abridgments while estimating panel data models in order to understand their characteristics. This allows the observer to highlight any differences in the variables, whether they fluctuate over time or between different entities.

Table 3.4: Descriptive Statistics for Panel Data

Variable		Mean	Std. Dev.	Min	Max	Obs
Id	overall	3.0000	1.423136	1	5	N = 80
	between		1.581139	1	5	n = 5
	within		0	3	3	T =16
Year	overall	2,012.5000	4.638856	2005	2020	N = 80
	between		0	2012.5	2012.5	n = 5
	Within		4.638856	2005	2020	T = 16
GDP_per capita	overall	724.6616	383.1022	151.6816	1,838.2100	N = 80
	between		343.9596	241.1123	1,193.7090	n = 5
	within		225.6606	42.5695	1,369.1630	T = 16
interest rate	overall	8.4820	7.9024	(34.4620)	21.7656	N = 80
	between		3.1153	5.3936	12.6529	n = 5
	within		7.3882	(38.6329)	21.2461	T = 16
exchange rate	overall	0.2988	0.4461	0.0268	1.4855	N = 80
	between		0.4875	0.0405	1.1676	n = 5
	within		0.0807	0.0706	0.6167	T = 16
Consumption _per capita	overall	629.2100	346.8711	158.5072	1,840.7420	N = 80
	between		310.4173	255.4544	1,120.0140	n = 5
	within		205.5643	(16.1287)	1,349.9370	T = 16
savings	overall	91.6528	93.1284	(35.4114)	356.0832	N = 80
	between		91.1923	(14.3421)	229.9988	n = 5
	within		43.9985	(23.3523)	217.7372	T = 16
Govt expenditure.	overall	804.4823	427.6742	186.1133	2,166.4560	N = 80
	between		379.6533	288.7517	1,352.6950	n = 5
	within		257.1698	16.7618	1,618.2430	T = 16
Net exports	overall	(146.9750)	207.7410	(1,041.4790)	(8.6555)	N = 80
	between		136.6136	(380.3040)	(36.4009)	n = 5
	within		167.4417	(808.1500)	198.2263	T = 16

Source: Author's computation from WDI data

Since Table 3.3 shows that, all variables vary between entities and within entities, we then focus on the standard deviation across and within variables. We can therefore determine the best panel data model to utilize, thanks to this distribution. It is notable that since investment, savings, consumption, government spending and net exports all contribute to GDP, this research applies savings as a stand-in for interest rates and net exports for currency rates.

3.4.1.2 Stability of the Exchange Rates and Interest Rates (Unit Root Test)

To examine the consistency (stability) of the macroeconomic factors, unit root tests were performed. When a time series has a unit root, it is termed as random; otherwise, it is stationary (stable). A graph may be used to investigate this and determine the curve's form, but in this study, numerous tests for the existence of a unit root are preferred, so that the conclusions are solid. The tests that were performed were as indicated in Table 3.4:

Table 3.5: Unit Root Test

unit-root test	Statistic	Exchange rate	P-value	Interest rates	P-value
Levin-Lin-Chu	Unadjusted t	-3.0963		-5.8736	
	Adjusted t*	-2.2798	0.0113	-3.7271	0.0001
Harris-Tzavalis	rho	0.8334	0.7688	0.0040	0.0000
Breitung unit	lambda	2.2547	0.9879	-0.7226	0.2350
Im-Pesaran-Shin	t-bar	-1.4807		-3.1026	
	t-tilde-bar	-1.3209		-2.1553	
	Z-t-tilde-bar	-0.0980	0.4610	-2.6615	0.0039
Fisher-type	Inverse chi-squared(10) p	8.5910	0.5713	40.1031	0.0000
	Inverse normal Z	0.1739	0.5690	40.1031	0.0000
	Inverse logit t(29) L*	0.1468	0.5578	-4.8916	0.0000
	Modified inv. chi-squared Pm	-0.3151	0.6236	6.7313	0.0000
Hadri LM	Z	11.5034	0.0000	3.2979	0.0005

Author's computation, 2021 using WDI data

The stationarity tests reveal that the exchange rates are generally non-stationarity since most of the test results are not significant. Looking at the p-values[9], most are greater than 0.05, making them insignificant. We therefore accept the null hypothesis that we have a unit root, which suggests that we have a random variable in exchange rates as the p-values are not significant.

As a result, the implications are that the Balance of Payments within these nations are rather uncertain since the exchange rates among the East African countries are mostly unstable. This would also imply that investors in the corresponding nations are unable to logical arrange for imports and exports. This is also most probably contributively to low foreign reserves.

Conversely, interest rates are looking to be often constant (stable) within East Africa as most of the p-values are less than 0.05. This strongly suggests that these nations' financial markets are generally consistent and that there is some extent of security in investing in the financial markets of EAC member states. The stationarity test was only failed by one test, the Breitung unit whose p-value is at 23.5% (0.2350), but since the great majority of tests revealed consistency (stability), we may infer that rate of interest are steady (stable).

3.4.1.3 Testing for Convergence

This segment determines if the interest rates and exchange rates of the EACs are converging with time, which is a sign that the gaps between the states with respect to these variables are closing with time. The study is done on two fronts: Sigma convergence and co-integration.

3.4.1.4 Sigma Convergence

By figuring out the variation of coefficients based on the specific variables and then regressing them against time, sigma convergence is studied. Convergence is shown by an inverse correlation between the coefficient of variation and the research duration. The inverse

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[9] A p-value less than 0.05 is typically considered to be statistically significant, in which case the null hypothesis should be rejected. A p-value greater than 0.05 means that deviation from the null hypothesis is not statistically significant, and the null hypothesis is not rejected.

connection implies that the relevant variable's variance is decreasing over time. The results of the investigation are first shown in Figure 3.1 as a curve that plots the coefficient of variation of the two important variables' temporal trends.
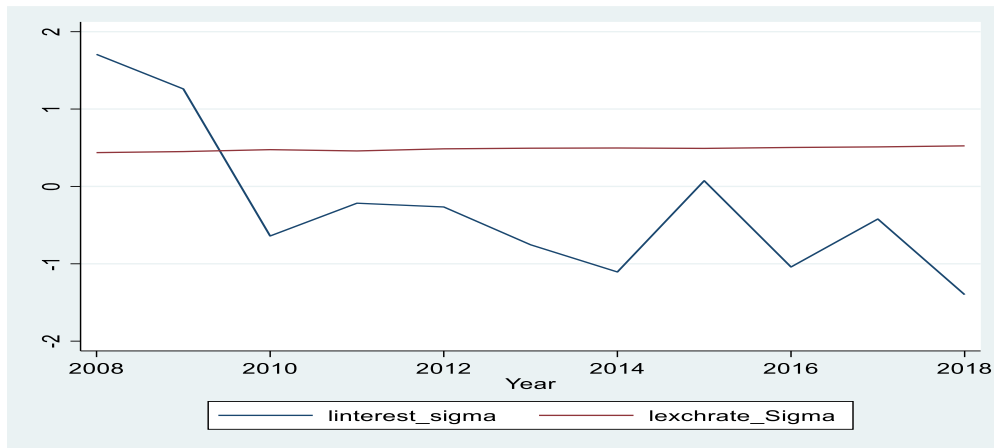
Convergence Curve

Source: Author's workings, 2021 using WDI data

The interest rates are clearly downward sloping, which shows that the interest rates' variability is dwindling with time an indicator of convergence. The exchange rates, however, appear to be relatively constantly rising. The trend analysis shown in figure 3.1 indicates that the exchange rates are not convergent but are more divergent.

Alternately, regression was done to see whether there is a significant positive or negative variation within the coefficient of variation with time t. The Sigma convergence regression results are shown in table 3.5.

Table 3.6: Sigma Convergence Regressions Results

	Interest rates	p-value	Exchange rates	p-value
Constant	433.7240	0.0090	-14.8578	0.0000
Year	-0.2156	0.0090	0.0076	0.0000

Source: Author's computation using WDI data 2021

It is clear from the regression results in Table 3.5 that the interest rate's coefficient of variation -0.2156, is decreasing with time (convergence), whereas the exchange rate's coefficient 0.0076

is positive (divergence). Both of them are significant going by the p-values, which are less than 0.05. As a result, we draw a strong conclusion that whereas exchange rates are diverging over time, interest rates are convergent over time.

3.4.1.5 Co-integration Test

According to co-integration, time series variables that are not stationary on their own can become stationary over the course of time if they are coupled with a different time series variable. Here, we check to see whether there is such a long-term common pattern in the exchange rates if combined with interest rate. Table 3.6 displays the outcomes:

Table 3.7:Co-integration Test

Co-integration test	Statistics	Coefficient	P-value	Significance
Kao test	Modified Dickey-Fuller t	2.3786	0.0087	*
	Dickey-Fuller t	3.6441	0.0001	***
	Augmented Dickey-Fuller t	3.4254	0.0003	***
	Unadjusted modified Dickey-Fuller t	-4.6938	0.5495	
	Unadjusted Dickey-Fuller t	-0.1737	0.4311	
Pedroni test	Modified Phillips-Perron t	1.1803	0.1189	
	Phillips-Perron t	-0.4440	0.3285	
	Augmented Dickey-Fuller t	-1.3758	0.0844	*
Westerlund test	Variance ratio	2.6469	0.0041	**

Note: * denotes Significant at the 1% level; **, Significant at the 5% level; *, Significant at the 10% level. Source: Author's computation, 2021**

This study sought to assess if a long-term connection exists (co-integration) between the two variables for the EACs or if there is none (absence of co-integration). Numerous checks were undertaken to ensure accuracy, and the majority of them certify that a long-term link is present between interest rates and currency rates. This is because a majority (5 out of 9) of the tests show significance at 1%, 5% and 10% and the p-values of at least three of the tests are significant. Consequently, we infer that the interest rates and exchange rates of the EACs are eventually going to converge or have long-term relation such that would lead them to stability in the future.

3.4.1.6 The Impact of Interest Rates and Exchange Rates on GDP

Theoretically, we understand that GDP is a function of net exports, government spending, consumption and investment. The currency rate and interest rates are the two main variables of concern in this research, whereby savings proxies for investments due to the non-availability of investment data. Consumption, government spending, and net exports are the additional variables that are included as control variables. Since they are known to impact on GDP, such control variables enhance the internal validity of a study by limiting the influence of confounding other variables. This helps you establish precise correlational or causal relationship between your variables of interest.

This analysis employs all panel data estimation techniques to evaluate the coefficients then conducts the Hausman test and Breusch-Pagan Lagrange Multiplier test to determine a suitable model that should be adopted. Table 3.7 presents the panel data estimations.

Table 3.8: Panel Estimation Models Output

GDP	Pooled OLS regression	Between	Within or fixed effects	First difference	Random effects
Interest rate	(0.0069)	Omitted	(0.0107)	(0.0287)	(0.0069)
Exchange rates	6.1802**	Omitted	(41.5787)**	3.2856	6.1802**
Consumption pc	0.7507***	0.2431***	0.7877***	0.8519***	0.7507***
Savings pc	0.9748***	0.6064***	1.0302***	1.0158***	0.9748***
Govt. Exp pc	0.1866***	0.6216***	0.1389***	0.0871	0.1866***
		(0.0711)	(0.0261)		
Net exports pc	(0.0212)***	***	***	(0.0254)***	(0.0212)***
Constant	7.9264***	5.6461***	31.5451***		7.9264***
R2	0.9996			0.9862	
R2- within		0.9961	0.9990		0.9989
R2- between		1.0000	0.9969		0.9999
R2- Overall		0.9986	0.9968		0.9996
Sigma u			28.0271		-
Sigma e			7.7617		7.7617
Rho			0.9288		-

Note: * indicates Significant at 1% level, ** indicates Significant at 5% level, and *** indicates Significant at 10%. Source: Author's computation, 2021

We then determined the apt model used for our study. To accomplish this, the Hausman and Breusch-Pagan Lagrange Multiplier tests are now carried out and the outcomes are tabulated in Table 3.8.

Table 3.9: Model Selection Tests

	Test	Statistic	p-value
Hausman test	chi2(1)	26.7700***	0.0001
Bresusch-pagan LM Test	chibar2(01)	0.0000	1.0000

Note: * signifies Significant at 1% level; ** signifies Significant at 5% level; * signifies Significant at 10%. Source: Author's computation, 2021 using WDI data**

When comparing the Fixed-effect model to the Random effect model, the Hausman test was used to choose between Within or Fixed effects and Random Effect models, and the findings were statistically significant (significance level 10% and p-value 0.0001) for the Hausman test. Since the regression data show Fixed effect model has higher R^2 (0.9990) and Rho values 0.9288 than the random effect model, it is indeed the fit. According to the Fixed-effect model's Rho value greater than zero, implies that individual-specific terms rather than idiosyncratic (individual model) inaccuracies account for 93% of the model's discrepancies. A zero Rho value for the random effect model suggests that the model inaccuracies 100% rather than individual errors are to blame for the discrepancies. Therefore, we dismiss the Random effect. The Bresusch-pagan LM Test was used to test suitability between Pooled OLS and Random effect. The Pooled OLS model is absolutely implied to be inappropriate for the study as there is even no R^2 and Rho values attached. Random effect model could have been declared fit by the Breusch-Pagan Lagrange Multiplier test, but the finding is non-significant (1.0000 p-value) and has no Rho value. As a result, the Fixed-effect model, which will serve as the basis for description, is the most appropriate model to explain the analysis's final findings.

Hence, using Fixed Effect model we find that the interest rate has a negative value of (0.0107) units. This means that the GDP would fall by 0.0107 units if the interest rate increased by one unit. It therefore means that it has that negative effect on GDP, although quite minimal. For the exchange rates, since the exchange rate's coefficient is both negative (41.5787) units and significant, it demonstrates that GDP would fall by 41.58 units if the exchange rate increased by one unit. This means that the nations' exports will significantly become reduced when their local currencies become stronger against the dollar than it is when its value has declined.

Consumption, savings, and government expenditure all have a significant impact on GDP as would be expected. However, net exports have a negative impact (0.0261) meaning more imports than exports, explaining why the EACs have been reporting unfavourable Balance of Payments. These countries are mostly net importers, according to the statistics provided.

The analysis of the status of convergence of the EAC monetary transmission mechanisms are based on the interest rates and the exchange rates. From macroeconomic theory, monetary policy in an economy directly affect the extent of supply of money in the economy, which are largely reflected by changes in rates of interest. The decisions of the central bank concerning monetary strategy influence the currency value of a nation. That also translates to changes in the exchange rates, where, if the currency becomes stronger, the economy is expected to realize fewer exports, and the imports are likely to increase as the imports become cheaper with respect to the strength of the local currency. Conversely, when the worth of the currency decreases, the economy is likely to realize increased exports and lesser imports. The convergence of monetary transmission mechanisms is therefore crucial in terms of financial integration as an economic block is gearing to realize a monetary union that is expected to spur regional trade.

3.5 Conclusion and policy implications

3.5.1 Summary of Key findings

The exchange rates are highly volatile while the interest rates are stable. Sigma convergence (σ) test indicates that there is a convergence tendency of interest rates. The rate of exchange, however, seems to diverge over time according to the sigma convergence test results. This is similar to the unit root tests, which also suggest that they are not stationary, we notice clear divergence of exchange rates among the member countries. The analysis further validates the existence of a long run connection in both the monetary policy transmission mechanism variables.

3.5.2 Conclusions

Based on the findings of the analysis, the exchange rates are volatile rather than stable. For a monetary union to be realized, the exchange rates should be strong, converging and stable so that cross-border trade can be planned for with certainty. With extreme exchange rate volatility, trade amongst the member states may become expensive leading to decreased volume of trade in the region.

The interest rates in the EACs are largely stable, which is a quality indicator, as the economic zone is preparing for the economic and monetary union. A stable interest rate amongst the EACs means that investors within the EACs can make investment decisions with a high degree of assurance that the prevailing conditions are not likely to change. This would also facilitate the ease of transferring money from one-member state to the other, which would further boost commerce and investing in the region.

The test of sigma convergence (σ) indicates that there is a convergence tendency of interest rates. This is a verification that the differences in the borrowing rates among the EACs are decreasing over time, hence they are linking up at a common value. This demonstrates that over time, there are less variances in borrowing rates among EACs, indicating that they are approaching a point of convergence. This lays a desirable basis for the establishment of a monetary merger. Additionally, it indicates that the criteria set up by the EACs to attain monetary integration are succeeding. The scenario is that the region's lending and borrowing rates are improving, which is a desirable indication.

The rate of exchange, however, seems to diverge over time according to the sigma convergence test results. This is similar to the unit root test, which also suggest that they are not stationary, we notice clear divergence of exchange rates among the member countries, hence more needs to be done regarding this variable to accomplish a monetary union. The EAC should device approaches that support stable rates of exchange among member countries in their pursuit of the monetary union. For example, the individual central banks could emphasize trading directly in the foreign exchange market.

The analysis further validates the existence of a long run connection in both the monetary conveyance variables. This demonstrated that, despite the variables' potent for individual volatility particularly the exchange rate, they share a consistent pattern over the long term, which is supported by the presence of long-term convergence. This indicates that both the two combined to continue working together, could lead them to be all be convergent individually in the long run. This also suggests that the EAC goal of founding a monetary union is still achievable especially by focusing in the financial sector through the two transmission channels. Therefore, the financial approaches in place should be maintained and possibly made stronger, though the goal of convergence will indeed take a long time to be realized.

Careful inspection of the influence of the rates of interest and rates of exchange on the GDP reveals that, rates of interest have insignificant influence on GDP but the influence of rates of

exchange is of negative significance from the Fixed-effect model. Hence, the rates of exchange have to be stable in order for the EAC to achieve significant economic growth. The monetary authorities should encourage trade in less expensive imports, which make the economies more powerful especially by substituting the current situation in the EAC states who heavily rely on net importing. Notably, stronger currencies contribute to low export values and hence lower GDP values, but conversely in turn leads to improved balance of payments for the member nations.

3.5.3 Policy implications

The instability in the EAC exchange rates necessitates the member nations to work jointly to establish measures that will create a stable currency environment for them. Some measures require the policy makers to team up together and set up monetary policies that may lead to correlated and stable rates of exchange in the community. Stable exchange rates would stimulate commerce between member states and minimize unreliability amongst the traders in the area. Central banks may manage their local currency by issuing new currency gradually, setting interest rates, and judiciously managing foreign currency reserves. This can also be done by the central banks expanding the money supply by creating reals, then use the reals to purchase foreign currencies, whereas avoiding use of own currency to purchase the foreign currency. In this way, it can fill the gap between quantity demanded and quantity supplied of its currency without reducing the foreign currency reserve. This would be done to complement the use of the interplay between interest rates and exchange rates of the commonly used monetary policy. The EAC should also establish techniques such as caps (ceilings) or bands to be strictly followed by the members for them to realize economic union in the long-run.

The two monetary policy channels; exchange rates and interest rates, seem to be co-integrating in the long run when combined together. Hence, a pointer that some of the monetary strategies in the region are functioning properly though very slowly. Therefore, they should examine and collate their macroeconomic policies that are contributing to the positive scenarios of convergences and seek ways to stabilize, especially the non-stationary exchange rates as revealed by the unit root test.

Lastly, variations in the EAC GDP are largely elucidated by the inconsistencies in the exchange rates, therefore, more resources should be channelled towards ensuring there is stability in the export market. The governments of these countries should encourage export-based production, which results in favourable balance of trade and payments. In short, monetary policies should

focus on local currency stabilization to ensure favourable competition with other currencies. Decision-makers should set up strategies that will strengthen home currencies in order to guarantee stronger EAC union as they prepare for the monetary union.

CHAPTER FOUR
THRESHOLD EFFECT OF MACROECONOMIC CONVERGENCE CRITERIA ON REAL GDP GROWTH RATE WITHIN THE EAST AFRICAN COMMUNITY

4.1 Introduction

The geographical region covered by the EAC is roughly 1.82 million KM^2 with a total population of about 133.1 million people, which is increasing at a faster rate. The EAC community, which in this study comprises Uganda, Tanzania, Rwanda, Burundi, and Kenya, has generally been experiencing population growth, although the growth rates differ from one country to the other. The total GDP recorded as at 2005 for the EAC region was USD 5.4 billion. This figure has risen to USD 212.2 billion by the year 2020. Figure 4.1 shows the trend in every single nation's per capita GDP expressed in USD.
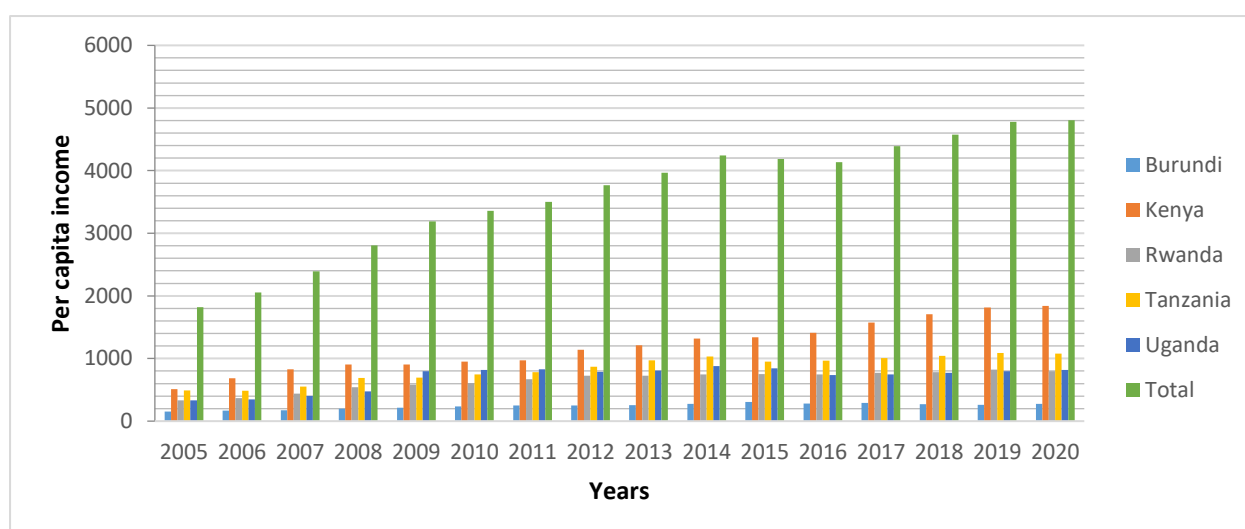
Figure 4.1: Regional Trends in GDP Per Capita

Source: Authors' computation using-WDI data

Kenya and Tanzania have the largest economies compared to the other EAC partner states, which also appear to develop but at fairly slower pace. The overall GDP growth rate of the EAC decreased during the global financial crisis of 2008 to 4.4 percent in the year 2009. However, it recovered to 5.9 percent in the following year. The EAC region's total per capita GDP in USD increased in general from $364 recorded in 2005 to $961 in 2020. The statistics reveal that the amalgamation efforts of the EAC has indeed boosted trading activities between

the member countries since the reviving of the community. Kenya imports more from the EAC community; however, its export quantities to the member states remain small. Nevertheless, the balance of trade among all the EAC member states is unfavourable due to their large imports and conversely low exports.

A reflection from the above descriptive statistics projects a region that indeed requires further integration beyond the existing customs union and the common market, for the member countries to fully tap into the potential that exists by forming a monetary union. However, the tradition before a monetary union is established has been that the regions specify the criteria for the convergence of key macroeconomic variables, which put on the right track the member countries towards the merger. EAC has not been left out in setting the macroeconomic policy guide for its member countries. Nonetheless, the starting has encountered low levels of commitment whereby at best only three out of five members has ever been achieved as taking part in the process. Another hindrance is establishing a coordinated method to harmonize the inter-country operations to realize the established goals; every state manages its macroeconomic schemes via the governmental operations, more so in economic environments that are unstable, causing the attainment of the convergence goals to be unfeasible.

4.1.1 Macro-economic Variables Convergence Criteria for the EAC

The final conclusive transformation of the EA nations to the monetary alliance is majorly hinged on the minimums that should be attained for subscriber states to realize full monetary integration benefits and robust economic stability and growth. The EAMC created and supervises the minimums. The specified principles are quite extensive and constitute largely traditional criteria derivatives and were further classified as primary and secondary. The stages were planned for rolling in two phases before embracing the monetary union in the third phase, (Kuteesa, 2012). The final stage designated as Stage II, is deemed the most critical of all. The stage which is to be rolled 2011-2014 is prescribed as follows: Budget deficit/GDP (excluding

grants) <5 percent, Budget deficit/GDP (including grants) <2 percent, External reserves (months of imports of goods and non-factor services) >6, Yearly rate of inflation <5 percent, Real GDP growth rate >7 percent, and National savings/GDP >20 percent. For more details, Table 1.1 of page 7 refers.

The precept of macroeconomic convergence that EAC adopted was derived from what their antecedents embraced to achieve a currency union. These associations comprise the EU, CFA, CMA, WAMZ, and UEMOA. They focused on manageable inflation, stability of exchange rate, boosting the forex reserves, setting financial restrictions such as controlling public debts, and budgetary shortfalls, while also supporting coordination of economic planning among the associating nations. Attainment of the provisions are highly anticipated to have a favourable impact on the economies, although depending on how they are handled, because they can also generate serious adversity. For instance, authorities will be needed to maintain reduced inflation, increased savings to GDP ratio, low budgetary deficits, and increased foreign reserves. These constitute the basic elements that could have either an upward or downward effect on economies, depending on how they are implemented. Many members of the EAC were found to operate below the set minimums during the early stages of adoption of the REC, (Nannyonjo & Asiimwe, 2014). However, some members have shown an improvement, but there are still incredible fluctuation patterns making it hard to predict future sustainability. Nevertheless, if the set minimums are attained, there is a likelihood of the members enjoying economic stability as well as faster growth.

In looking at each of the prescribed variables; inflation: reasonable low and steady inflation results in enhanced welfare of the people. For instance, it promotes investment rather than just self-protection against the effects of rising inflation as generally perceived, which results in the effective use of production resources by investors. This is in contrast to the general rising inflation, which causes investments to experience negative returns. Stable inflation also boosts

confidence in the projected returns on investments. Businesses and residents in economies with low inflation are better positioned to make long-term investments in a stable macroeconomic environment and foster desired economic growth than those in economies with high and erratic inflationary patterns, Adusei (2012).

As for budgetary deficits; whereas traditional economists pressed for a balanced or deficit budgetary, the acceptance extent of budgetary shortfall is still a contentious issue, (Bhorat & Hirsch, 2014). Some argued that a deficit if left to run autonomously, the economy would just revert to its previous natural steady state. Public debt arguably, is also likely to displace private borrowing, manipulate interest rates and capital structures, lower export quantities, and eventually lead to high taxes and inflation, or both, which would diminish productivity. Contrastingly, Keynesians recommended a demand-driven economy in which the government increased expenditure by borrowing money. Keynes advocated for countercyclical fiscal approaches, according to which the government should begin with deficit spending during an economic downturn to counteract falling investment and spur consumer spending while supporting total demand and growth, (Nkrumah, 2016). Nevertheless, for day-to-day operational basis among member nations, low fiscal deficits are recommended hence communities like EAC who are preparing to form a monetary union do specify their maximum threshold.

Concerning foreign reserves, the central banks should maintain reasonable amounts of foreign reserves, since they allow the central banks to handle the depreciation of the country's currency. When currency depreciation sets in, the government can sell the foreign reserves and purchase local currencies hence stopping the local currency from depreciation. While possession of foreign reserves is advisable, it is still crucial to set a limit to prevent retaining reserves that could be invested elsewhere in more earning alternatives, (Ajibola et al., 2015). Reserves are a necessary element for both the government and private investors to utilize for the external

payment of imports, such as capital goods that directly support rapid economic growth. The length of time that the foreign reserves can fund imports in the event of an economic crisis is also critical and is often expressed in months. Therefore, it is unarguably important for each member state of an integration to possess reasonable amount of reserves in custody.

Nonetheless, questions about the attainment and maintenance of the specified thresholds in the actual market structure of the region emerges. One, did empirical findings validate them or were they merely obtained from other regional blocks? How acceptable are they in the East African market environment in a manner that would generate desired economic growth? Therefore, these questions call for establishing the actual conducive minimums, validated by the existing statistics from within the East Africa's regional market instead of entirely embracing and implementing criteria picked from other trading blocs, as they may be unfit and inefficient for the region, and may fail to promote the economies as anticipated.

4.1.2 Statement of the Problem

Due to ambitions to expeditiously move the aims and aspirations of the regional corporation, the EAC was reinstituted in 1999. Following that, they resolved on a strategy to set up a CU, then a CMP, and eventually looked forward to a MU to be in place by 2012. To achieve the MU they specified prerequisites for the participating nations before joining the monetary union.

The defined criteria however, might have been benchmarked with those of other regional blocks that have instituted monetary alliances, without taking enough time to analyse and match them to the local markets. Besides, since the inception of the criteria, 10 years have elapsed, a time within which the structures of the regional markets may have changed due to elements such as demography, status of natural resources, political environment, and even impacts of global economic dynamics and preferences, which would render them irrelevant with time. This would require a re-evaluation of the criteria on the context of the local markets and through the period that has elapsed.

Nevertheless, there is even an inherent problem; member countries have been unable to attain the specified threshold levels. This raises the questions of the appropriateness of these standards in light of the local markets' present status. The criteria must be based on real local data collected from the implementation area and analysed to determine their appropriateness, particularly, in light of the overall priority goal of every nation, that of GDP growth and eventual economic development. Inferentially, there appears to be great challenge of balancing act on the variables with regard to meeting floors and ceilings, whereby each of them have pros and cons to some level in whichever way you flex them. In summary, it is clear that so far there is no evidence to validate the appropriateness of these set thresholds in light of the local operational market environment.

To support, evaluate, or otherwise provide advice on the criteria chosen by the EAMC, this study tries to establish the ideal minimums backed up by empirical data. This will provide the EAC nations guidance on the viability of the criteria that the EAC designated as the prerequisites for a nation to meet to enter the monetary union. These requirements might be too lax, to the extent of creating a monetary union that may be of little or no advantage to the members, or they could be too tight, making them unattainable for members to meet. In general, thresholds might be retrogressive, which would impede general economic expansion in the region.

Looking at previous efforts at integration, the EAC identified priority areas of intervention between the years 2006 to 2010: they developed the three major objectives that involved consolidating and completing the EAC CU, establishing a CMP, and ultimately putting up a framework for a MU and a Political Federation. The broad objectives were accompanied by wide plans for infrastructural development and enhancement of productivity, institutional development and capacity building, plus increasing stakeholder involvement and empowerment. The CU established in 2005 aimed at advancing local, cross-border, and

international investment. It also targeted promotion of industrial diversification, to further the integration process and enhance efficiency in production through intra-regional completion of business cycle to intensify economic development, (People & Destiny, 2011). However, these objectives have faced a myriad of challenges that include complex customs administration, weak facilitation of trade, insufficient revenue management, and inappropriate trade partnership, including limited capacity to human and capital resources. Additionally, national trade barriers take time to eliminate leading to delays in implementation of regional commitments, whereas some members have also chosen multiple memberships. With all these members have continued to see weak legal regulatory and dispute settlement mechanisms persisting, (People & Destiny, 2011).

The CMP objective was further intended to enhance policy harmonization, through legal regulatory framework, establishing supportive institutions that would promote investments in the private sector, and ensure efficient and effective service delivery while promoting broad stakeholder involvement. However, this has been slowed down by several factors: inadequate institutions, poor national and regional ability to domesticate regional regulations, and lack of free access to information. The member states are not adequately informed, and in a situation where the legal and regulatory frameworks are inappropriate, protectionism persists, the private sectors are stagnated and weak. The difference in the education systems further exacerbates the situation, because the systems unable to nature integral objectives towards the integrational goals. Concisely, there is cultural and language diversity, weak capacity of implementing agencies, inadequate safeguard measures, weak dispute resolution mechanisms, and disparities in the intraregional trade which are indeed significant barriers, (People & Destiny, 2011).

Negotiations for a MU began in 2010, and the creditable gains so far realized include currency conversion, synchronizing of banking rules and regulations, unifying some monetary and fiscal policies, consolidation of trading practices, and regulations in the stock exchange markets. The

setbacks since 2010 include: fear of the impact of a single currency, the regional and national coordination capacities are limited, plus social and economic policy structures being different, whereas political commitments and views also still differ. The legislative and institutional frameworks for managing a robust financial sector are still inappropriately constituted and the fears of adverse effect given that member states have unsustainable external debts is still majorly irresistible.

The setbacks compounded with the unachievable macroeconomic convergences set the stage for inquiring into the question whether the thresholds that were adopted by the EAMC were appropriate, effective and adequate. It is also noteworthy that probably the delayed MU, could constitute a deeper integration which could be the main remedy to most of the economic woos phased in the region, so that the nations and their general citizenry can get the opportunity to benefit what they deserve sooner than later.

4.1.3 The Research Objectives

The broader goal of this study is to determine the appropriateness and the effectiveness of the criteria adopted by the EAC on regional economic growth.

4.1.3.1 The specific objectives of the study

i.   To establish the actual data thresholds for macroeconomic variables within the EAC.

ii.   To analyze the difference between the actual data thresholds and the thresholds set by the EAMC.

iii. To determine the impact of the thresholds on the GDP growth rate within the EAC.

4.2 Literature Review

4.2.1 Theoretical Literature

4.2.1.1 The Traditional OCA Theory

The research on the influence of real GDP growth by the macroeconomic convergence principle of thresholds is based on the OCA concept, which outlines the requirements for joining a currency union. The assumption requires real wage flexibility, labour mobility and fiscal policy integration to function. In Figure 4.2, the vertical axis depicts the actual disparity between countries seeking to join a MU.
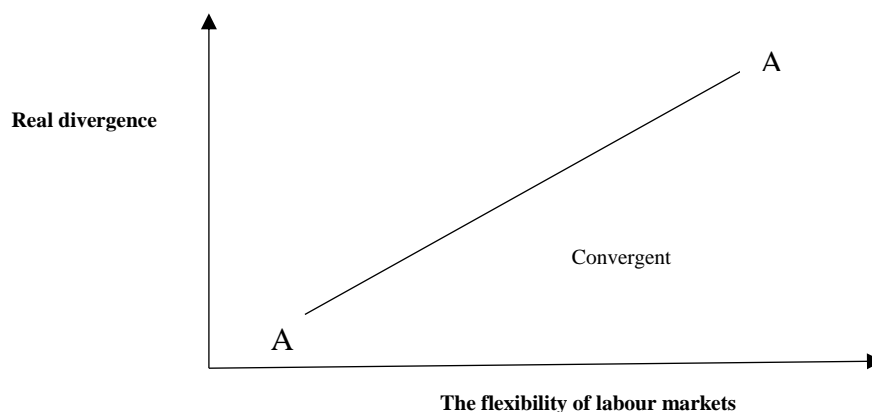
Figure 4.2: The Optimal Currency Area Theory (OCA)

Asymmetric shocks cause a significant divergence between neighbouring countries, whereas symmetrical shocks are handled differently due to differences in economic structures and policies. The horizontal axis depicts the region's labour market flexibility, which reflects interregional labour mobility and real wage flexibility.

The OCA hypothesis states that to join a MU without making major modifications, nations with significant disparities in GDP and employment patterns will need an extremely flexible labour supply. The labour supply market has to be more flexible when actual divergence is considerable for the monetary union to work well.

The link between actual divergence and adjustability is depicted by the upward-sloping line AA. Countries beyond this line, in contrast to those below it, must adapt to be able to join a MU. The optimum currency area (OCA) is formed by the nations under the AA line, and joining

a monetary union does not entail significant adjustment costs for them. Countries above the line have less labour market flexibility, and they must have a versatile rate of exchange to join a MU. According to the hypothesis, nations that are unable to comply, a MU will make them struggle to manage their macroeconomics. If certain member countries face asymmetric shocks, a debate will erupt over what schemes the central bank of the area should promote concerning their macroeconomics to tame the situation. According to (De Grauwe, 1996), if expansionary intervention is required, the unaffected nations may decide to take another action, resulting in the MU's setback.

As per the OCA hypothesis, nations with varying rates of economic growth and organizational characteristics must achieve true convergence. Convergence refers to a situation whereby countries undergo significant changes structurally and institutionally, culminate into more synchronized economies and working processes. This is why as a result; convergence criteria for states wishing to enter a MU were developed. The principles were originally employed in the Maastricht Treaty, which established the EU. It stated, in a nutshell, that economies of each government must meet fiscal and monetary stability; with prices, long-term interest rate and national exchange rate stabilization criteria in place.

4.2.2 Empirical Literature
4.2.2.1 Inflation Threshold

(Lee & Wong, 2005) explored the possibility of an ideal inflation threshold by evaluating the connection between economic growth and financial deepening. The ideal inflation ceiling in Taiwan and Japan was calculated utilizing a threshold regression model. The findings demonstrate that financial progress will support economic expansion, but while maintaining low and moderate inflation. They discovered that while Japan should have an inflation rate of 9.66 percent, Taiwan should have an inflation rate of 7.25 percent. However, it was only during

the 1970s, when both nations were dealing with severe inflation and an oil crisis, were these levels reached.

In another research, (Fabayo & Ajilore, 2006) looked at the relationship between Nigeria's inflation cap and economic growth. They proved that a 6-point inflation cap is adequate using data from 1970 to 2003. Data exhibited that inflation is positively correlated with economic expansion below that level, but above that point, heightened inflation produces a decline in economic growth. The Nigerian government was advised to aim attaining an inflation rate that is less than 10 percent with an eventual target of 6 percent; they withheld this after doing a thorough investigation to support their results.

Another study was carried out in Malaysia by (Munir et al., 2009) to look at the link between inflation and economic expansion using data from 1970 to 2005. The (Hansen, 2000) constructed threshold model was used to analyse the data. Finding the ideal rate of inflation threshold for the nation was the study's main goal. Significant evidence of a nonlinear link between inflation and economic growth was discovered by the study. They discovered that the optimal inflation rate is 3.89 percent, below which the association between inflation and economic expansion is positive, and beyond which the rate of economic growth is impeded significantly. They concluded that the Malaysian government should understand the advantages of low inflation and create an adequate monetary strategy.

(Adusei, 2012) used yearly inflation data from 1965 to 2010 to test if a threshold impact would hold for South Africa. He identified a 7 percent inflation rate limit through the application of nonlinear regression models in the inquiry. Statistics showed that inflation has a detrimental effect on economic expansion over this point. He asserted that to achieve economic development, the South African government needed to keep inflation below 7 percent.

The connection between inflation and Vietnam's economic growth was examined by (Tung & Thanh, 2015), shortly when a market economy had eventually just replaced the communist economy with aspects of central planning in Vietnam. The study employed two-stage least square (2-SLS), OLS, and GMM to analyse data from 1986 to 2013. The optimum margin for the country was 7 percent, and they found that any rise over this mark would have unfavourable effects. They concluded that government officials had to establish an inflation target of below 7 percent to guarantee steady economic development.

4.2.2.2 Budget Deficit Threshold

Employing data from 1981 to 2014, (Kabuga & Ahmed, 2018) explored how budget shortfalls affected Nigeria's economic development between those years. An autoregressive threshold model was used to establish the ideal budget deficit level, which they established at 5 percent of GDP. They stated that there is a persistent budget imbalance in the country and that the budget shortfall should ideally be kept under 5 percent of GDP. Other elements in the model, such as capital, labour, inflation, and trade openness, had a strong positive association with GDP.

Sierra Leone had a persistently growing fiscal deficit before 2013, so the government implemented strategies to address the issue. The urgent policy option was to lower the level of spending by the government; however, they discovered that to build a budget that was appropriate for the economic situation, they needed to create a sustainable budget deficit. These factors prompted (Onwioduokit, 2013) to employ nonlinear Least Square approach to investigate the ideal budget deficit threshold for Sierra Leone. He concluded that 7 percent of GDP was the acceptable level and that anything above would be detrimental to the expansion of the economy. According to his findings, Sierra Leone should devise policies that produce annual budget deficits of no more than 7 percent of the country's GDP.

(Kanwal et al., 2019) carried out similar research in Pakistan to ascertain the connection between budget shortfall and economic development as well as whether or not there is a threshold below which economic growth is ideal. The research's dataset covered the years 1972 to 2014. It was intended to provide a standard that would enable policymakers to choose whether or not to utilize fiscal stimulus to boost GDP. Using time series data, they applied a smooth transition, autoregressive model. They established a cap of 5.57 percent of GDP, which if surpassed, would have a detrimental effect on GDP. They concluded that a financial strategy that maintains the budget shortfall within permitted limits encourages economic expansion provided public expenditure are directed toward appropriate initiatives that support long-term growth goals.

(Nkurumah, Orkoh, & Owusu, 2016) used quarterly data to examine the connection between Ghana's budget shortfall and economic progress from 2000 to 2015. The investigation made use of trend analysis using the ARDL model. They discovered that the economy grew slowly the next year in 2000 when the budget deficit was high, and vice versa. Their general agreement was that a large budget deficit had a detrimental effect on economic expansion. They found that a 1percent sluggish economic expansion was caused by a 1percent rise in the budget deficit. They concluded that a significant budget shortfall does not always imply economic growth and that the government needed enforcing rigorous fiscal austerity to protect its population from the harmful impacts of heavy debt, particularly for posterity.

4.2.2.3 External Reserves Threshold

This topic has seen a wide range of research whereby for instance (Nwachukwu et. al., 2016), investigated the long-term relationship between Nigeria's foreign reserves and exchange rates. Utilizing daily data from 2014 to 2015, they determined the ideal threshold for foreign reserves using the Threshold Vector Error Correction Model (TVECM) methodology. The Nigerian central bank was in charge of regulating the Bureau De Change (BDC) currency rates and

foreign reserves utilized in the simulation. They discovered a nonlinear long-run connection between the variables, which validated their usage of TVECM. The two series showed co-integration when they crossed the specified threshold. The data showed two stages, with the expected being in charge of 93.1percent of observations and the unexpected being in charge of 6.9 percent. Additionally, they discovered that the second phase's error correction coefficient was statistically significant at 10 percent, but it was not statistically significant at 5 percent for the first phase. They found out that the external reserves offer the adjustment mechanism between the two parameters for the BDC exchange rate.

Using quarterly data spanning 1990 Q1 to 2012 Q4, (Ajibola et al., 2015) conducted further research to explore the long-term link between Nigeria's foreign reserves and currency rate. Instead of linear co-integration, they discovered proof of the variables' threshold co-integration. Consequently, they calculated a two-regime TVECM using the greatest likelihood method. The research showed that the equilibrium errors must reach the predicted level of 0.52 for the two components to co-integrate. Exchange rates did not compensate for the equilibrium error during the course of the assessment period, as shown by the fact that the error correction coefficients for the two regimes are not significant. They discovered that, in contrast, external reserves adjust to take into account historical variation. This occurs when the equilibrium error approaches the threshold parameters. They concluded that to retain the long-run equilibrium error, frequent adjustments to foreign reserves would be required. The outcome was consistent with the monetary authority's intention to use foreign reserves to maintain currency stability in the nation.

(Chong et al., 2008) looked at the association between developments in foreign reserves and currency crises. They observed that the exchange rate systems break down when foreign reserves are quickly depleted. They discovered using the autoregressive threshold model that the economy is likely to experience an exchange rate catastrophe if the reserve-to-external-debt

ratio and the reserve-to-M2 ratio both fall below 24.3 percent within six months. Finally, they concluded that the model they used offers policymakers a warning system to take action to prevent reserves from declining to such catastrophic levels.

Threshold influence of MU on connection between financial autonomy and foreign reserves was examined by (Law et al., 2019) in separate researches. They employed cross-sectional data from 55 industrialized and emerging nations, collected between 2012 and 2014, to evaluate linear and threshold models. The research showed that for economies to attain monetary independence, foreign exchange reserves must remain above a particular level. The results showed that countries needed to maintain foreign reserves above a particular level to achieve financial integration and monetary autonomy.

4.2.2.4 Literature Overview

Some studies used non-dynamic panel threshold regression while others used non-dynamic panel smooth transition regression. However, studies applying these estimation techniques are not able to account for the endogeneity problem created by the inclusion of initial income (an important variable in growth models) among the control variables. This can create endogeneity bias, hence misleading threshold estimations. To address the endogeneity problem that could arise, this study uses dynamic panel threshold regression approach in examining the threshold effects of macroeconomic variables in the EAC. Lastly, most panel studies on the threshold effects of macroeconomic variables on growth for developing countries combine in their samples, countries from Asia, Latin America and Africa, countries that are at different stages of economic development, which can also be misleading. This study specifically focuses on the EACs, which are on average in the same category of development.

In conclusion, the literature review above shows that majority of studies looking at thresholds have focused on certain factors of intrigue such as the impact of the thresholds of budget deficit, inflation, interest rates and foreign reserves on economic growth. These studies did not look at

the effects of MU thresholds on member-countries' economic growth plan and who are operating on pressures to meet prescribed thresholds. The reviewed findings therefore encouraged this study to examine the optimal threshold values for the EAMC using the most recent data. This study also looks at the EAC, specifically because there is an ambition to enter a MU but no past research on how pre-determined growth targets have affected the region's growth variables.

4.3 Methodology

4.3.1 Theoretical Framework

The Maastricht Treaty and the theory of OCA, which states that countries should meet certain thresholds before forming a stable currency union, laid the groundwork for the analytical strategy employed in this study, (De-Grauwe, 2006). An international central bank of the setting receives a unitary authority to flex monetary instruments for nations in optimal currency areas. It is therefore important to discuss standards for entering monetary unions while taking into account the unique circumstances of the participating nations before eventual entry to the union.

These countries develop convergence criteria primarily utilizing permissible positions of their joint financial committees, where they establish rules that member states must achieve and uphold before entering the monetary union. These requirements are normally set by the regional monetary committees and become prerequisites to be met by any neighbouring or even otherwise nation intending to join the MU.

As soon as a monetary union is created, the supra-central bank assumes the responsibility of the union monetary policy, and anytime a nation experiences an economic shock, they take the appropriate steps to stabilize the macroeconomic circumstances in the area. In this case to prevent heightened debates at time requiring significant fiscal actions of scale to rescue a participant experiencing a severe economic blow, it is crucial for countries wishing entry to a

monetary union to first acquire a level of commonality in macroeconomic policies and financial systems, (De Grauwe, 2006).

4.3.2 Model Specification

The budget deficit, inflation, and external reserves thresholds were examined using the dynamic threshold panel model shown in equation (4.1).

$$y_{it=} \begin{cases} u_i + \beta_1' x_{it} + e_{it}, & q_{it} \leq \gamma \\ u_i + \beta_2' x_{it} + e_{it}, & q_{it} > \gamma \end{cases} \qquad (4.1)$$

The panel has to balance where $\{y_{it}, q_{it}, x_{it} : 1 \leq i \leq n, 1 \leq t \leq T\}$. Individual changes in the model are represented by i while changes that occur over time by t. y_{it} is the predicted variable, and the threshold is given by q_{it}, while x_{it} represents other control variables which may have k vectors. Depending on whether the threshold is higher or lower than the threshold γ, several regimes can exist in this model but here two regimes are used. The regression slopes for the two regimes are β_1 and β_2 respectively. The model makes the following assumptions:

i. x_{it} is time-invariant for consistent estimation of β_1 and β_2

ii. The threshold variable q_{it} is also time-invariant

iii. The error term is independently and identically distributed (iid) having a zero mean and finite variance δ^2

The assumption of iid ensures that there are no lags in the depended variables from x_{it}.

The dynamic threshold model has an advantage over the static/traditional threshold model in that, in addition to establishing the possibility of the existence of a threshold, it also deals with potential endogeneity in the data since it employs the Generalized Method of Moments (GMM) model. To deal with the endogeneity problem, the procedure uses a tool, a variable matrix that is orthogonal to the random perturbation term, which is constructed to ensure that the variable matrix tool is not connected to the random perturbation term. A grid research algorithm

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(system) is employed in this model to establish the threshold value that ensures the requirement of endogenous grouping is fulfilled hence solving the problem of endogeneity within the variables, (Ran et al., 2020).

4.3.3 Data Types and Sources

Data applied in this research came from the World Bank website's subcategory of World Development Indicators, which covers the years 2005 through 2020. The applicable variables are listed in Table 4.1.

Table 4.1: Definition of Variables

VARIABLE	Data Description	Source
Gross National Product in USD	For the duration of the study, the GDP of the East African nations is given in US dollars.	World Bank Development Indicators
Total foreign exchange reserves	For the nations of East Africa, the total foreign currency reserves are reported in USD. Measured in months of imports.	World Bank Development Indicators
Gross domestic savings	For the whole period, each nation's total savings is reported in USD. The overall savings will be used as a stand-in for the investments made by East African nations.	World Bank Development Indicators
Inflation	The percentage change in Consumer Price Index (CPI) on a year-on-year basis.	World Bank Development Indicators
Government expenditure	For all EAC nations, government spending is stated in USD.	World Bank Development Indicators
Net exports	For all the nations in East Africa, the Net Export is computed in USD.	World Bank Development Indicators
Debt financing	The amount of the nation's short-term debt peroxides the government's overall debt year after year. Measured as a percentage of GDP.	World Bank Development Indicators

Source: WDI data

4.4 Results and Discussion

4.4.1 Descriptive Statistics

A descriptive statistical analysis for the panel data was performed to gather the essential facts and figures used in the study. Following the analysis, the research can determine in case the variables vary across individuals and time. Panel data descriptive statistics are as shown in Table 4.2.

Table 4.2: Panel data descriptive statistics

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

Source: Authors computation.

Table 4.2 reveals that all variables vary with time and across individuals. It is interesting to gauge the data's distribution by looking at the standard deviation across and within each variable. Budget deficit, foreign reserves, and inflation are the analysis' key threshold factors, whereby external debt is used as a proxy of budget deficits, since data for some states were unavailable, unlike overall reserves and inflation in months of import. For investments, savings were employed as a substitute, government spending, consumption, and net exports, all these being the study's control variables.

4.4.2 Empirical Results

In order to examine if a threshold exists, the empirical study was carried out applying the Dynamic Panel Threshold Model and Dynamic Panel Data. Using a Bootstrap-based Wald test, it was determined that a threshold effect existed. From the East African Monetary Committee's selection of the macroeconomic variables as variables of concern, the study first gives them null hypothesis, which means that none of them exhibits a threshold effect. The measurement variables are foreign reserves, fiscal deficit, and inflation. Each of the variables is individually examined across three sides of analysis; for instance, as can be seen in table 4.3; Inflation 1, 2 and 3.

4.4.2.1 The Threshold for Inflation within the EAC

Less than 5% yearly inflation is the requirement set forth by the EAMC for states to meet before implementing a MU. Table 4.3 reveals the threshold values for inflation.

Table 4.3: The Threshold Values for Inflation

Threshold Parameter	Threshold value	P-value	BS	Confidence interval		Wald statistics	Critical values		
				Lower	Higher		10%	5%	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: Author's computation using WDI data

The minimum actual data threshold was found to be 7.5 percent, which is far more than the requirement specified by the East African Monetary Committee of 5%. The statistics acquired evidently suggest the existence of a single threshold, and the P-value of ≤ 0.05 is significant. The value of Wald statistics is also larger than all critical values at 10%, 5%, and 1%, as shown in Table 4.3, and is further evidence that the conclusion is correct. Consequently, the dynamic threshold model disproves its initial null hypothesis that a threshold does not exist. The test for the second and third criteria's existence is inconsequential as the p-values and Wald statistics are not significant. The results, consequently reveals that the East African nations are not

abiding by the Monetary Committee's stipulated threshold as the data clearly gives a higher threshold.

Table 4.4, gives the results of the regression used to check for the impact of the EAMC thresholds on GDP.

Table 4.4: Inflation Threshold Regression

Variable	Model 1	Model 2	Model 3
Consumption	0.9180***	0.9161***	0.9135***
	(0.0210)	(0.0211)	(0.0212)
Investment	1.0956***	1.0989***	1.1004***
	(0.0249)	(0.0250)	(0.0250)
government	1.0562***	1.0629***	1.0846***
Expenditure	(0.1471)	(0.1469)	(0.1477)
Net export	-0.2621***	-0.2620***	-0.2495***
	(0.0628)	(0.0625)	(0.0632)
Inflation $\leq \lambda$	0.2332***		
	(0.0433)		
Inflation $\geq \lambda$	0.0359		
	(0.0261)		
Inflation $\leq \lambda$		0.2785***	
		(0.0483)	
Inflation $\leq \lambda$		0.0362*	
		(0.0260)	
Inflation $\leq \lambda$			0.0130***
			(0.0327)
Inflation $\leq \lambda$			0.0530*
			(0.0297)
Cons	1.6524***	1.6525**	1.5446**
Wald test	13006.09***	11199.22***	9850.61***
N	80	80	80

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

Source: Author's computation using WDI data

The outcome for model 1 gives evidence that, when inflation is employed with a threshold variable, there is a notable threshold influence on the East African nations' GDP. When inflation is under (Inflation $\leq \lambda$)) 7.5%, the impact is substantially favourable (positive) 0.233 units, significant at 1% level of confidence. If inflation exceeds (Inflation $\geq \lambda$) the 7.5 percent threshold, the anticipated inflation coefficient falls to 0.0359 units, which is also statistically insignificant. We may thus infer that inflation is important and contributes more to GDP growth at rates lower than (Inflation $\leq \lambda$) 7.5 percent within the EAC.

It should be highlighted that the second and third models are insignificant. What we see far below are for Inflation 2 and 3, which were found to be insignificant as per the p-values and Wald test values.

(Adusei, 2012) established a threshold of 7 percent for South Africa, which is similar to the finding of this study. He suggested that the extent of inflation in South Africa was favourable up to that level and ought to be maintained below that margin. In recalling that a maximum of 5 percent inflation was approved by the EAMC as a threshold allowable for GDP growth for the EACs, we can now conclude that this threshold is far below the market data threshold.

4.4.2.2 The Threshold for Budget Deficit within the EAC

The ratio of the EAMC budget deficit to GDP criteria, which the partners in the EAC are required to adhere to for the successful creation of a monetary union, was supposed to be below 6% by 2010, and less than 5% by 2014. Since there was no information on the budget shortfall, the paper utilized the foreign debt as a substitute to determine the best level of borrowing for the various states. Table 4.5 provides a list of the external debt threshold amounts.

Table 4.5: The Threshold Values for the Budget Deficit

Threshold Parameter	Threshold value	P-value	BS	Confidence interval		Wald statistics	Critical values		
				Lower	Higher		10%	5%	1%
External Debt 1	1.62	0.036	1000	0	0	15.44	8.5069	13.6971	24.3094
External Debt 2	0.97	0.4400	1000	0.96	1	1.57	6.0284	7.7769	23.3290
External Debt 3	1	0.5440	1000	0.97	1.04	0.89	3.6136	5.1659	10.7943

Source: Author's computation using WDI data

The dynamic threshold model disproves its prior premise that a threshold does not exist since examination of the gathered data reveals the existence of just one threshold and the Wald statistics are relevant up to 5%. The thresholds presence in the second and third tests are not statistically meaningful going by both Wald statistics and p-value.

The actual market threshold, 6.16 percent computed being the threshold as a percentage of the average debt as indicated in table 4.5, is slightly higher than the East African Monetary Committee's specified ceiling. The number is in billions with a minimum of $1.62 billion and a value of 6.16 percent when computed against the average GDP for the research duration.

This evaluation of 6.16% reveals that the EA states' borrowing is above the extent specified by the EA Monetary Committee of 5%, for helping the region achieve a monetary unification. The Wald statistic's value that surpasses the critical percentages of 10% and 5%, lends credence to the conclusion. The criteria have not been fulfilled despite the data being stretched to 6 years after the chosen date of 2014. Members must thus devise strategies for becoming more independent from external borrowing.

When using External Debt as a threshold variable, model 4 regression outcome in Table 4.6 reveals that there is a substantial threshold influence on the GDP of EA nations.

Table 4.6: 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****
Expenditure	(0.1526)	(0.1590)	(0.1603)
Net export	-0.1529**	-0.1238	-0.1155*
	(0.0612)	(0.0659)	(0.0686)
External debt $\leq \lambda$	0.0160		
	(0.0290)		
External debt $\geq \lambda$	0.1473***		
	(0.0290)		
External debt $\leq \lambda$		0.0262	
		(0.0369)	
External debt $\geq \lambda$		0.1578****	
		(0.0389)	
External debt $\leq \lambda$			0.0401
			(0.0570)
External debt $\geq \lambda$			0.1601***
			(0.0395)
Cons	0.7441	0.4461	0.3824
Wald test	12044.25***	9650.67***	8347.43***
N	80	80	80

Note that *, **, and * correspondingly denote significance at 1 percent, 5 percent, and 10 percent levels. Standard errors are shown as figures (). Source: Author's computation using WDI data**

When the amount of foreign debt is smaller than (External debt $\leq \lambda$) $1.62 billion, it has little impact of only 0.0160 units. When external debt exceeds (External debt $\geq \lambda$) standards of

$1.62 billion, the projected coefficient of external debt rises to 0.1473 units, which is significant at 1%. According to the assessment, it would be acceptable for subscriber nations to borrow more than the allotted limit of 5% because when the debt-to-GDP ratio is lower than 6.16 percent, states are likely to see sluggish economic development. In table 4.7 at the level lower than 6.16% debt the impact of per unit change of debt there is the insignificant positive 0.016 units change in GDP. Whereas per unit change of debt above 6.16% there is the significant positive change of 0.1473 units in GDP. As a result, the EA Monetary Committee should rethink of raising the target debt to GDP ratio towards the optimal value 6.16%, which is beyond the level recommended by the convergence criterion of 5% of GDP and should therefore be at least 6 percent.

The ideal threshold discovered is comparable to that set by Kanwal et al. (2019), who defined a limit of 5.57 percent for the budget deficit that the Pakistani government should not go beyond. Notably the results of the second (Model 5) and third (Model 6) do not show any significance, and therefore their interpretation is not necessary.

4.4.2.3 The Threshold for External Reserves within the EAC

By 2014, the overall reserve in months of import required by the EAMC to qualify a nation for membership in the monetary union should have been enough for longer than 6 months. Table 4.7 displays the reserve threshold values in months.

Table 4.7: The External Reserve Cut-off Values

Threshold Parameter	Threshold value	P-value	BS	Confidence interval		Wald statistics	Critical values		
				Lower	Higher		10%	5%	1%
Reserves 1	4.01	0.083	1000	3.84	4.03	12.09	10.3335	16.543	31.7762
Reserves 2	4.86	0.000	1000	4.82	4.94	80.54	9.0986	13.6679	29.2316
Reserves 3	3.93	0.088	1000	3.8	3.97	11.46	10.5924	12.6767	24.9967

Source: Author's computation using WDI data

Only one threshold of 4.86 months is found when the data are examined. The Wald statistics is significant at 10%, 5% and 1%; P-value of 0.000 is also significant, for the second threshold

test. As a result, the dynamic threshold model disproves its initial claim that a threshold does not exist.

We will concentrate on the first and second threshold values, which are is 4 and 4.86 months, but which are below the level that the EAMC laid target (6 months), for the East African nations to operate at.

The third threshold is below the first and second threshold and therefore not valid. The community was required to have more than 4 months of import reserves by 2010 and more than 6 months' worth of reserves by 2014, according to the deadline they set. Based on data collected from 2005 to 2020, the ideal threshold was found at 4.86 if rounded it becomes about 5 months. The Wald statistics' values, which are greater than the critical levels up to 10%, further support the conclusion. From Table 4.8, the regression findings for model 7 demonstrate that when reserves in months of imports are less than (Reserve in months $\leq \lambda$) 5 months' reserve on imports, there is a threshold effect on the GDP within the East African Countries that is negative -0.028 units, though not significant.

Table 4.8: External Reserves Threshold Regression

Variable	Model 7	Model 8	Model 9
Consumption	0.9067***	0.9465***	0.9282***
	(0.0231)	(0.0212)	(0.0192
Investment	1.1223***	1.0696***	1.1050***
	(0.0275)	(0.0254)	(0.0238)
Government	1.1314***	1.1166***	1.0517***
Expenditure	(0.1555)	(0.1464)	(0.1300)
Net export	-0.2330***	-0.1167*	-0.1747***
	(0.0658)	(0.0609)	(0.0553)
Reserve in months $\leq \lambda$	-0.0277		
	(0.0370)		
Reserve in months $\geq \lambda$	0.1190***		
	(0.0311)		
Reserve in months $\leq \lambda$		-0.4179***	
		(0.1021)	
Reserve in months $\geq \lambda$		0.0264	
		(0.0345)	
Reserve in months $\leq \lambda$			-0.2433**
			(0.0981)
Reserve in months $\geq \lambda$			0.0409
			(0.0307)
Cons	1.3293	0.1171	0.8636
Wald test	0.6383***	11207.23***	12589.58***
N	80	80	80

Note: ***, **, and * indicate the significance at 1%, 5%, and 10% levels, respectively. Figures in () are the standard errors. Source: Author's computation using WDI data

When the values are more than (Reserve in months $\geq \lambda$) 5 months, the influence of external reserves on the months of imports coefficient is positive and significant 0.12 units at 1 percent. Model 8's second threshold is substantial -0.4 units, but its coefficients (0.102) are much less than those of model 7, hence lacking clarity so we will focus our discussion on Model 7's regression instead.

As a result, the reserves measured in months of imports are optimal at 5 months. 4 months was the suggested threshold that the East African Monetary Committee specified as the goal that participating nations must have met by 2010, this has indeed been accomplished. However, the optimal threshold does not reach the intended level of over 6 months for import months by 2014, even as the data spans from 2005 to 2020.

In the regression analysis, the influence of reserves is not significant on GDP if this level is lower than 5 months, it is a negative (-0.0277 units) but insignificant, but when it is beyond this margin of 5 months it is a positive and significant 0.1190 units at 1%. This is similar to that of Jibola et al. (2015), who employed co-integration to make their discovery of 5 months for Nigeria.

On the results of the analysis of foreign reserves, the ideal level is 5 months' worth of imports rather than the 6 months suggested by the monetary committee, according to regression outcome of reserves in months of imports. It is obvious that higher reserves are needed so that, in the event of a crisis, these countries can finance their imports and protect their currencies from negative repercussions for longer periods. The EAC members are now running below the desired level of 6 months. In order to enable the countries to create greater reserves than are apparent from the available data, the community should take more action to boost export production and ensure that exports exceed imports. However, in order for members to join the MU much more quickly, the East African countries should ask the East African Monetary

Committee to cut the criteria that members amass foreign reserves for 6 months of imports to 5 months of imports, which is apparently the data-optimal level. Nonetheless, establishing strategies that can be implemented to encourage increased production in the region and decrease over-dependence on imports would also be exciting for future research so that member countries may swiftly build up foreign reserves.

4.5 Conclusions and Policy implications

4.5.1 Summary of Findings

The best-accepted margins for inflation, budgetary deficit and reserve of foreign currency are 7.5 percent, 6 percent, and imports for 5 months. These amounts are juxtaposed with the minimum requirements set by the EA monetary committee, which are 5%, 5%, and 6 months' worth of imports, respectively.

4.5.2 Conclusions

The ideal margin of inflation from the statistics is a little higher at 7.5 percent, which exceeds the EA monetary committee's suggested rate of below 5 percent. Economic development requires low inflation and the committee's suggested rate lies within the range, where economic growth changes favourably. The evidence reveals that the EAC subscriber nations have leeway to raise their inflation threshold value by a margin of an additional 2.5 percent to register more economic growth.

The EA Monetary Committee advices that by 2014, the budget deficit to GDP ratio should be at ≤ 5 percent. The actual ideal proportion of debt-to-GDP is at 6% excluding domestic borrowing and grants, and this is 6 years down the line since 2014. This corroboration insinuates that craving for deficits funding among the EAC participants is far beyond the level required to drive the region towards monetary union. Normally, states would attempt to balance their borrowing so that they avoid spending great proportion of their domestically created income for repayment of outstanding loans and interests in the short run.

However, as per the analysis, EAC members are likely to experience reduced growth when borrowing levels are less than 6% threshold and thereafter, the effect is notably negative (0.1473) and statistically significant at 1%, when borrowing is increased. This means that as the borrowing persists, additional growth will be registered until up to 6% threshold. The data results, however, reveals that the members of EAC rely largely on borrowing for their economic growth, a situation that must be corrected sooner than later.

The East African Monetary Committee advised that participants achieve 6 months in import reserves in order for the area to embrace a monetary union formation. The regression on months of imports threshold reveals that the ideal requirement within the EAC is 5 months of imports. Examined empirical literature, were found to use what reserves could buy rather than how many months of imports they could cover, in their research which did not reveal the standards used in this study. Therefore, achieving positive GDP growth is indeed optimal at the suggested threshold of 6 months. Members will experience rising GDP as long as they keep building up their reserves for months longer than the threshold of 5 months. However, data indicates that member states are just marginally meeting the suggested target of 6 months. This necessitates additional policies and initiatives to help member states achieve this level. But still it is recommendable to be reduced to 5 months.

4.5.2 Policy Implications

The East African Monetary Committee recommended that the inflation rate criteria be at 5% which is well under the regional optimal with the ceiling at 7.5%. Thus, this evidence suggests that it is very tight that members should not be permitted a margin of 2.5% to choose in case they need to allow their inflation to increase. Low inflation sustains economic growth hence the EAC should continue supporting low inflation levels. However, some level of inflation would support exports since locally produced goods will become cheaper than those produced in other countries. The export promotion is due to the local currency being cheaper than the

foreign currencies. Therefore, the East African governments should renegotiate with the East African Monetary Committee to allow for a window for member countries, who desire to participate in the MU to exceed the current threshold by not more than 2.5%.

Growth within the EAC is strongly dependent on borrowing from abroad, as demonstrated by the threshold test for the budget deficit exemplified by foreign debt. That is why debt threshold is positive and immensely significant at 6.16%, however low borrowing levels below the threshold would not be optimal for economic growth. The debt threshold can be increased to 6% as suggested by the data-optimal threshold, but these economies' reliance on debt is not a positive feature, hence more initiatives are needed to help them become more independent. Injecting foreign debt into the economy may provide the impression that it is growing in the short term, but the long-term effects of debt repayment, including interest, may put these countries on serious constraint of repayment that they will not see significant growth in the future. Therefore, the East African governments need to seriously consider their appetite for borrowing if they intend to establish stable economies that will not be chocked by debt repayment. The level of borrowing is so high that forming the MU might never be realized if members continue with the current trajectory. Future studies should be able to use actual data on budget deficits. The analysis chose to use a proxy because the data supplied did not contain accurate figures on the budget deficit for the nations in the East African region. This is an issue that requires additional understanding.

On foreign reserves, the ideal level is 5 months' worth of imports rather than the 6 months suggested by the monetary committee, according to regression outcome of reserves in months of imports. It is obvious that higher reserves are needed so that, in the event of a crisis, these countries can finance their imports and protect their currencies from negative repercussions for longer periods. The EAC members are now running below the desired level of 6 months. In order to enable the countries to create greater reserves than are apparent from the available

data, the community should take more action to boost export production and ensure that exports exceed imports. However, in order for members to join the MU much more quickly, the East African countries should ask the East African Monetary Committee to cut the criteria that members amass foreign reserves for 6 months of imports to 5 months of imports which is apparently the data-optimal level. Possibilities of establishing strategies that can be implemented to encourage increased production in the region and decrease over-dependence on imports would also be exciting for future research so that member countries may steadily build up foreign reserves.

<center>**CHAPTER FIVE**</center>

SUMMARY, CONCLUSION, AND POLICY IMPLICATIONS

5.1 Introduction

This chapter presents the summary, conclusion, and policy implications for future policy formulation based on empirical data. It also gives a succinct overview of the overall study results in particular. Three objectives' applicability is used to determine the suggested policies: (1) the Convergence of macroeconomic variables, (2) the Stability of monetary policy transmission mechanisms, and (3) the suitability of convergence thresholds adopted by the East African community monetary committee.

5.2 Summary of the study

The EAC was first established in 1999 when the first treaty was signed, they then later agreed to form a customs union by signing another treaty in 2004. In 2009, they further agreed to a common market, with an ultimate objective to form a monetary union by 2012. To date, there is little or hardly any evidence to demonstrate that any of the agreements have been achieved. Individual nations are still acting independently protecting their interests at the expense of the neighbouring countries. There is still evidence of protectionism, where member countries are imposing taxes on trade with their neighbours, there is still no free movement of labour, and incidences of members locking their borders, whenever there is a misunderstanding are not uncommon.

These occurrences provoke the need to investigate the measures that were adopted by the EAMC to ensure that the monetary union is achieved. The first objective largely shows the absence of convergence in macroeconomic policies that are more fiscal in nature to converge over time. The analysis used Panel data running from 2005 to 2020. The Sigma convergence (σ) test did not support the decline of variation around the mean for the macroeconomic variables in question. Beta convergence (β) test showed divergence rather than convergence,

and finally, the stochastic convergence tests have largely supported that the macroeconomic variables are not stable but are rather co-integrating in the long run. Thus raising hope of stability in the future.

The analysis of the second objective on the convergence of monetary policy transmission variables showed that exchange rates are diverging, and that interest rates are convergent. The analysis further shows that the two variables are co-integrating in the long run. The regression analysis using panel data indicates that the exchange rate is significant in effecting changes in GDP, unlike the interest rates, which have no significant impact. Therefore, the monetary authorities are relatively doing well unlike the fiscal policies analysed in Chapter Three. The financial institutions in the region seem to be gravitating to a common operating environment, which may promote the adoption of a monetary union through a supra-central bank for the region. Even so, the countries seem to be adopting different external trade policies, which is evident by the divergence in exchange rates. The monetary institutions need to promote policies that would lead to the desired level of export in the member countries. The member states need to promote value addition in their supply side to improve the inflow of foreign reserves which would, in turn, improve the status of the exchange rate i.e. stability and favourability.

The third objective is tested using threshold analysis to test for the appropriate threshold supported by actual data from the EAC. Evidence largely suggests that the thresholds adopted by the EAMC are within the recommended levels of the thresholds that would promote an increase in GDP but there is room for adjustment as the thresholds adopted are too stringent, and may not be soon practicable for the members to attain them according to the data. Therefore, the EAMC needs to decide whether they need to loosen their stance so that the member countries may be enabled to join the union in the shortest time possible.

5.3 Conclusions

Macroeconomic variables of interest in the study are not showing convergence and co-integration for the period of study. This means that the EAC is not pursuing common objectives geared towards the ultimate objective of convergence. The sigma convergence, beta convergence, and co-integration tests have all failed. Less developed countries are expected to grow at a much faster rate to catch up with relatively developed peers for the unions to be adopted; the analysis largely shows divergence rather than convergence.

The exchange rates in the region are volatile, they are not stationary but the interest rates are stationary. Volatile exchange rates bring about uncertainty in conducting business, and hampering the desire for a common currency in the EAC. The co-integration test reveals that the monetary policies are converging over time, which is a good indicator for the region. The financial sector can generally be considered to be on the right track to the attainment of the convergence objective of the EAC. The fixed-effect model shows that exchange rate convergence has a remarkable influence on the GDP hence the need for the EAC to harmonize their exchange rates.

Lastly, the thresholds adopted by the EAMC are more stringent than the thresholds that are generated from actual data. This shows that the thresholds may have been benchmarked from other monetary unions before analysing the actual situation within the EAC. The EAMC needs to adjust the adopted thresholds to suit the existing conditions in the region if the desire to create a currency union is to be achieved in the foreseeable future.

5.4 Policy Implications

The study suggests that some EAC nations have policies that are distinct from those of the other nations in the region. As a result, for the currency union to be successful, the EAC nations must make substantial changes to harmonize their fiscal and monetary schemes. The EAC

nations should also give themselves adequate time to coordinate their monetary policies to further convergence and raise the likelihood of a credible and long-lasting monetary union.

The EAC community needs to review the measures that have so far been agreed upon, and that need to lead the member countries to the desired levels of macroeconomic stability. The approach should be that they come up with a mechanism that would ensure that members institute policies that would drive their respective nations to the set thresholds, which should be tailored to their individual needs. They should establish sanctions and penalties for the members, who fail to adhere to the agreed tailored policies for each country that would enable them to achieve the regional objectives.

The second objective analysis shows that the monetary institutions in the EAC are relatively doing well in terms of harmonizing their interest rates; they are converging over time. This means that the measures that have been adopted by these institutions are bearing fruit, and policymakers need to keep at them. However, the fluctuation in exchange rates represents a bigger proportion of the GDP changes in the EAC. Therefore, greater resources must be devoted to preserving the export market's stability. Governments should encourage output that is driven by exports since it will result in a positive trade balance. The goal of monetary policy should be to stabilize domestic currencies so they can compete fairly with other currencies. If the EAC's unity is to be enhanced, officials should seek strategies that would strengthen the regional currencies.

A lot needs to be done to reduce dependence on imports so that the foreign reserves in months can be improved. Most of the East African countries are net importers, making the desire to realize six months of imports almost impossible to attain. The way out of this is for the region to cooperate, realize economies of scale, and establish manufacturing industries that would promote export of finished products from the region. The governments may also come up with

tax incentives for export processing companies to encourage investment in their production for export purposes. As a policy implication, the various structural and institutional factors that lead to various degrees and patterns of financial intermediary growth largely defy monetary policies, which are frequently uniform for all member states. To improve the efficiency of monetary policy, member states should endeavour to harmonize cross-country policies. In addition, basing the thresholds on local empirical data may yield better compliance than adopting what other regions have used, which may be misleading. This means that the EAMC needs to reconsider its adopted thresholds so that it can accommodate all the members in the region much faster because they are way past the stipulated time for establishing the regional monetary union.

5.5 Further Areas of Study

Future analysis should conduct an in-depth investigation on why the macroeconomic variables that are fiscal in nature are showing divergence rather than convergence in the case of the EAC. According to the macroeconomic model by (Solow-Swan, 1956), smaller economies would grow much faster and catch up with their relatively developed peers due to the diffusion of skilled labour and technology. The financial sector is doing much better than fiscal measures in terms of attaining convergence for the region; exchange rate volatility would hamper stability in conducting trade in the region, hence the need to investigate what measures need to be taken to achieve convergence. The agreed protocols of CU and CMP adopted seem not to yield much as was intended. This area also need to be researched further. The economic experiences related to COVI-19 pandemic may have impacted on the progress of the EACs towards achieving the Macroeconomic Convergences. The depth of the impacts may need to be checked.

Finally, actual statistics on budget deficits need to be collected over time to measure their impact on the region accurately. This section requires a more profound understanding since the

available data lacks specifics on the East African nations' budget shortfall, which is why the study chose to employ proxies.

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