MACROECONOMIC CONVERGENCE AND BUSINESS CYCLES SYNCHRONIZATION TOWARDS A MONETARY UNION IN EAST AFRICAN COMMUNITY

DAVID KIRIMI MBUI

A THESIS SUBMITTED TO THE SCHOOL OF ECONOMICS IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY IN ECONOMICS OF KENYATTA UNIVERSITY

APRIL, 2021

DECLARATION

This thesis is my original work and has not been presented for an academic award in any other University.

Signature_____ Date _____

David Kirimi Mbui

B.A. Economics (Egerton University), M. Econ (Kenyatta University)

K96/CTY/30840/2015

We confirm that the work reported in this thesis was carried out by the candidate under our supervision.

Signature_____ Date _____

Dr. Angelica Njuguna

Senior Lecturer

Department of Econometrics and Statistics

Kenyatta University

Signature_____ Date _____

Dr. Jacob Omolo

Senior Lecturer

Department of Applied Economics

Kenyatta University

DEDICATION

To

My wife Betty, Children Joy, Liz, Gideon and Daniel.

ACKNOWLEDGEMENT

I would like to express my gratitude to God Almighty for granting me the will power and divine health to write this thesis. I would sincerely wish to appreciate my supervisors Dr. Angelica Njuguna and Dr. Jacob Omolo for their immense support, guidance and contribution in the development of this thesis. Were it not for their intellectual guidance, constant support and patience, this thesis would not be what it is. My special thanks also go to Professor Germano Mwabu, Dr. George Kosimbei, Dr. Forah Obebo, Dr. Charles Nzai and Dr. Shadrack Mwilaria for their time in reading this work and offering comments that have improved this thesis. I am greatly indebted to all my 2015 classmates for their encouragement, moral support and critiquing this thesis. I also appreciate the support and prayers from my wife Betty, children Joy, Liz, Gideon and Daniel without whom I would not have reached this far. Finally, I am grateful to Kenyatta University for bestowing me the opportunity to pursue this programme through the staff development scholarship.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

AFDB	African Development Bank
AUC	African Union Commission
CEMAC	Economic and Monetary Community of Central Africa
CARICOM	Caribbean Community and Common Market
COMESA	Common Market for Eastern and Southern Africa
CEN-SAD	Community of Sahel-Saharan States
EAC	East African Community
ECCAS	Economic Community of Central African States
EACB	East African Central Bank
EAMU	East African Monetary Union
ECB	European Central Bank
ECOWAS	Economic Community of West African States
ECU	European Currency Unit
EMI	European Monetary Institute
EMU	European Monetary Union
ESCB	European System of Central Banks
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
IGAD	Inter-Governmental Authority on Development
IGADD	Intergovernmental Authority on Drought and Development
MERCOSUR	Southern Common Market
OCA	Optimum Currency Area

RECs	Regional Economic Communities
SACU	South African Customs Union
SADC	Southern African Development Community
UMA	Arab Maghreb Union
SADCC	Southern African Development Coordination Conference
UNECA	United Nations Economic Commission for Africa
WAEMU	West African Economic and Monetary Union
WTO	World Trade Organization

OPERATIONAL DEFINITION OF TERMS

Business Cycles synchronization:	The high degree of correlation among business cycles of EAC member states or the tendency of business cycles in EAC to conform to a similar pattern or have a long-run association
Convergence:	The movement of macroeconomic variables of countries to a common steady state meaning a decline in the differences in the macroeconomic variables from the reference economy in this case Kenya
Fiscal variable	Budget deficit of countries in EAC.
Income Convergence:	The tendency of poorer economies growing at a faster rate than rich economies in GDP per capita so as to reach a steady state.
Macroeconomic Convergence:	This is the tendency towards the equalization of the macroeconomic variables namely; growth rate, exchange rate, inflation rate and fiscal deficit among EAC countries
Monetary Union:	This is the adoption of a single currency by EAC member countries or the pegging of their exchange rates to keep the value of their currencies at a certain level.
Monetary variables	Variables in the EAMU protocol which include

	exchange rate and inflation rate.
Steady Growth:	Balanced growth with stable or mild fluctuations in GDP.

ABSTRACT

The world economy has undergone unprecedented intensification of economic and political integration since the twentieth century. Developments in trade and capital account liberalization, as well as technological innovation in transport and telecommunications, have increased the international exchange of factors of production and final products and thus, integration. For regional economic blocs envisaging to form a monetary union, macroeconomic convergence is vital for deeper integration. The East African Community member countries like other regional blocs are in the process of forming a monetary union. The regional bloc has put in place macroeconomic convergence criteria as part of the targets that member states should fulfill before commencement of a monetary union. Although the bloc has put in place the criteria for regional economic integration towards a monetary union, it was unable to enter into a monetary union in 2015 as was envisaged, necessitating extension of the deadline to 2023. Attainment of macroeconomic convergence criteria by the respective member states has been slow and with significant variations. This has raised questions on the readiness of East African Community to proceed with the arrangement of the formation of a monetary union. The purpose of this study therefore, was to analyze the macroeconomic convergence and business cycles synchronization towards monetary Union in the East African Community. The study is anchored on two theories namely: the optimum currency area theory and the neoclassical growth theory. The study used time series and a set of panel data for the period 2000 to 2018. The first objective of the study was to establish the state of income convergence among East African Community member countries and Generalized Method of Moments estimation technique was employed to achieve the objective. The second and third objectives of the study were to evaluate the state of convergence of monetary variables and fiscal variable, respectively. Panel random effects model and time series model was used to achieve the second and third objectives. The fourth objective of the study was to analyze synchronization of business cycles in East African Community countries and cointegration analysis was employed to achieve the fourth objective. The key study findings were that there was empirical evidence to support the convergence in economic growth and monetary variables in the East African Community member states. There was, however, no empirical evidence of convergence of fiscal variable in East African Community member countries. Further, the study confirmed that business cycles among East African Community member countries were synchronized which is necessary for monetary union formation. The study findings, therefore, provided some evidence that East African Community member states were converging albeit slowly. The study recommended that East African Community countries ought to develop growth enhancing policies to spur economic growth thus aiding convergence of monetary and fiscal variables. This could be done through investment in infrastructure, increased credit to private sector and a reduction in interest rates. The East African Community secretariat should also be empowered to monitor the implementation and adherence to the convergence criteria by the member states as this would ensure convergence of economic growth, monetary variables and fiscal variable. Enhancement of bilateral trade among partner states through full implementation of the customs and common market protocols is necessary.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Regional integration is a form of collective management and exercise of sovereignty by nations through such means as transfer of partial sovereign power to a joint organization. The nature of such collective organization varies according to the degree of joint management and exercise of sovereign power achieved such that those in which the transfer of sovereignty is most advanced become super national entities (Oloruntoba, 2016). Regional integration is thus not merely the increase of interdependence among nations but rather, an advanced form of regionalization.

The economic view of regionalization may be defined as efforts to form free trade zones and through the formation of common markets, the coordination of economic policies and the implementation of shared economic policies to form even larger economic zones (Oloruntoba, 2016). For effective regional economic integration, there are a number of requirements that are necessary. These include geographical proximity and similarities in culture, similarities in the history and ideology, competitive or complementary economic linkages as well as a common language among the partner states (Ombeni, 2011).

The world has experienced an unprecedented and intensified economic and political integration since the twentieth century. This, according to Zahrnt (2005), is partly due to frustrations occasioned by the sluggish nature of trade negotiations under the World Trade

Organization (WTO). The efforts towards regional integration have been supported in many countries by regional policy initiatives, particularly in the field of trade resulting in a proliferation of regional agreements that vary widely in breadth and depth (Armengol, MacKay, & Pineau, 2004). Additionally, regional economic integration has been enhanced by technological innovations in transport and telecommunication. Developments such as trade and capital account liberalization have also played a role in promoting regional integration process (Ombeni, 2011). The process of regional integration has been accompanied by the strengthening of economic and financial linkages within geographic regions (Armengol, *et al*., 2004).

The main objective of economic integration is the creation of a common economic space among participating countries with an aim of promoting economic and political cooperation [Economic Commission for Africa (ECA), 2006]. Countries form regional economic blocs mostly to increase cross-border trade and investment and also to raise living standards for their citizens. These economic blocs are platforms for specialization and trade creation, which bring about real gains in terms of greater choice, lower prices, and increased productivity (Fratianni, 2006). Regional economic integration has become prevalent and has gained momentum among various regional trading blocs in the world that it cannot be ignored. Economic blocs offer advantages in terms of scope and flexibility in comparison to global trade agreements negotiated under WTO multilateral rounds (Armengol *et al*., 2004). The process of regional integration has taken different patterns across the world.

Europe has a long history of regional integration that is underpinned by a strong institutional structure. Economic integration in Europe began in 1957 after six countries namely; West Germany, France, Italy, Belgium, Netherlands and Luxembourg formed the European Economic Community (EEC) which adopted a common external tariff (Nugent, 2017). The nations formed EEC with the aim of adopting an external tariff and ending the frequent wars between neighbours, which culminated in the Second World War (Nello, 2009). In the subsequent years, these countries were joined by United Kingdom, Denmark, Ireland, Greece, Spain and Portugal (Cameron, Côté, & Graham, 2005). The member countries completely removed all restrictions on the free movement of goods, services, labour and capital among its members in 1993 (Cameron *et al*., 2005). Economic integration in Europe deepened further with the formation of a monetary union in 1999, which resulted in the expansion of trade among the member states (Zentralbank, 2015).

Monetary integration in Europe was undertaken in three phases. The first phase commenced with the signing of the Maastricht Treaty on 7th February, 1992 that outlined the convergence criteria to a monetary union (Wyplosz, 1997). These criteria inter alia, imposed control over inflation, public debt and public deficit. The criteria also outlined exchange rate stability and the convergence of interest rates. The first phase was marked by complete freedom for capital mobility, unrestricted use of the European Currency Unit (ECU) and improvement of economic convergence (Mongelli, 2008).

The second phase commenced in January, 1994 and involved the irreversible convertibility

of currencies. It is during this phase that a key institution, the European Monetary Institute (EMI), was established with the aim of strengthening central bank cooperation and monetary policy coordination. The institution also put in place mechanisms that were necessary for the establishment of the European System of Central Banks (ESCB). This was a requirement for the conduct of the single monetary policy and for the creation of a single currency in the third stage (Bitzenis & Andronikidis, 2006).

The third and final phase of monetary integration in Europe commenced in January, 1999. The phase started with the introduction of the Euro currency in eleven EU member states, establishment of the Eurosystem, and transfer of responsibility for the conduct of monetary policy to the European Central Bank (ECB), (Mongelli, 2008). According to Mongelli (2008), the intra-EU exchange rate mechanism and the stability and growth pact came into force during this final phase of the EU monetary integration.

Unlike Europe, North America chose a regional integration pattern of a free trade area arrangement that does not foresee the creation of supranational institutions (Armengol *et al*., 2004). The Northern American countries namely; Canada, Mexico and the Unites States formed the North America Free Trade Agreement (NAFTA) in 1994. The agreement aimed at promoting free trade in goods and services. Besides, NAFTA aimed at increasing investment through elimination of tariff protection, reduction of non-tariff barriers, introduction of General Agreement on Trade and Tariffs (GATT) as well as trade and investment-related disciplines (Fischer, 1998).

Following examples of the western countries, regional trade and integration agreements proliferated among developing countries in Africa, South Eastern Europe, Latin America and Asia. The Association of South-East Asian Nations (ASEAN) was established by Indonesia, Malaysia, Singapore, Thailand and the Philippines in 1967 (Dramani, 2010). The aim was to promote economic growth, social-cultural progress and development in the South-East Asian region through multilateral cooperation (Hill & Menon, 2014). Trade integration in East Asia grew at a rapid pace as a result of exploitation of intra-regional comparative advantages. The 1997-98 Asian crisis made the market-led process to be accompanied by closer inter- governmental coordination which embraced monetary and financial spheres as well as trade (Armengol et al., 2004). The member countries focused on assisting each other in fields of agriculture, research, education, transport and communication.

Likewise, the Southern Common Market (MERCOSUR) established in 1991 by Argentina, Brazil, Paraguay and Uruguay aimed at forming a common market along the lines pursued by the European Union (Porrata & Rafael, 2004). The treaty called for creation of a common external tariff (CET) with free movement of goods, services, currency, and people between member countries. However, the initial objective of a common market and coordinated economic policies by the member countries suffered setback caused by financial turbulence in the region in the late 1990s. The grouping is yet to recover momentum (Armengol *et al*., 2004).

Following the wave of regional economic integration in many parts of the world, Africa too started focusing on regional economic integration as a strategy for attaining sustainable economic growth and development. After independence, African countries found the need for association to surmount many daunting obstacles to their development (Agbonkhese & Adekola, 2014). The general consensus has been that by amalgamating its economies and pooling its capacities, endowments and energies, the continent would overcome its daunting development challenges (ECA, 2010). According to ECA (2010), regional integration in Africa remains a key strategy that will aid governments to accelerate the transformation of their disjointed small economies. This is through the expansion of markets and widening of the region's economic space. The ECA (2006) argues that regional integration will help African countries to reap the benefits of economies of scale from production and trade, thus maximizing the welfare of their nations.

There are fourteen regional economic communities (RECs) in Africa. However, only eight are recognized by the African Union Commission as pillars of the African Economic Community (ECA, 2010). These include Community of Sahel-Saharan States (CEN-SAD), Common Market for Eastern and Southern Africa (COMESA), East African Community (EAC), Economic Community of Central African States (ECCAS), Economic Community of West African States (ECOWAS), Intergovernmental Authority on Development (IGAD), Southern African Development Community (SADC) and Arab Magreb Union (UMA). Every country in the continent is a member of at least one regional economic

grouping reflecting overlapping membership, which may hinder deeper integration process in the continent (Seid, 2013).

Africa's regional economic integration was inspired by the seeming recognition that without unity, newly created African states would find it difficult to make progress in an international system dominated by powerful, rich and industrialized countries of the West (Jiboku & Okeke, 2016). Like the EU integration process, Africa implemented a linear approach, which starts with a free trade area (FTA), followed by a customs union, a common market, and then the integration of monetary and fiscal matters to establish a monetary union (Hartzenberg, 2011).

The Africa Union's (AU) strategy for establishing a Monetary Union is dependent upon successful formation of monetary unions in the RECs which are considered as building blocks towards a monetary union for the continent (Githuku, Omolo & Mwabu, 2018). Africa has many RECs but there exist a few RECs that are pursuing the establishment of monetary union along the lines of European Monetary Union (EMU) (Nnanna, 2006). Among them are the EAC and SADC where the member states have put in place mechanisms to guide the regional blocs towards a monetary union. The SADC had set the objective of adopting a common currency by the year 2018. However, SADC did not achieve the objective for the countries are yet to form a customs union and a common market (Mapuva, 2014). The EAC on the other hand extended its target of formation of a monetary union from 2015 to 2023 (Drummond *et.al*., 2015).

African countries have also established institutions to steer the process of integration similar to the model adopted by EMU. The institutions involved include the African Union Commission (AUC), the African Development Bank (AfDB) and the United Nations Economic Commission for Africa (UNECA). These efforts are expected to converge towards an African Economic Community with uniform monetary, fiscal and social policies (ECA, 2012).

1.1.1 Economic Integration in East African Community

The EAC was established in 1967 through a treaty that was signed between the then member countries: Kenya, Uganda and Tanzania. Under this treaty, the three countries agreed to cooperate on economic, social and political issues (Masinde & Omolo, 2017). The first EAC and the steps towards regional integration which it achieved, was hailed as a success at the time (Eyster, 2014). Masinde and Omolo (2017) observe that the EAC was considered at the time a model of regional integration and development. However, the regional bloc did not last long and it collapsed in 1977. The collapse of the bloc was attributed to lack of a steering function, the perceived unequal distribution of benefits among the respective member states, political and personal differences of opinion between leading players particularly Uganda and Tanzania (Eyster, 2014). The REC was officially dissolved in 1984 when the mediation agreement for division of assets and liabilities was signed. The individual countries reverted to regulating their economic affairs by means of bilateral and multilateral agreements (Ombeni, 2011).

The EAC member countries did not abandon the quest for regional economic integration. The REC was re-established in 2000 with the aim of broadening and deepening cooperation among the member states. The priority areas of cooperation identified were political, economic, research and technology, security, legal and judicial affairs, and social and cultural fields (Kuteesa, 2012). The treaty that re-established the EAC was signed in November 1999 by Kenya, Uganda and Tanzania. The treaty entered into force in July, 2000. Rwanda and Burundi joined the EAC in 2007 (Davoodi, 2012).

The EAC regional bloc was re-established with a vision of making East African countries prosperous, competitive, stable, secure and politically united (Ombeni, 2011). It was envisaged that the integration would provide a platform to broaden political, cultural and economic prospects of the region to improve quality of life for the member states through higher investment and increased production (Waffubwa, 2014). The regional bloc envisioned the formation of a monetary union by 2015. The objective of the monetary union was to promote and maintain sustainable growth and development of the community. The formation of East African Monetary Union (EAMU) was to be achieved through a process starting with creation of customs union (2005), common market (2010), monetary union (2015) and ultimately a Political federation of the East African States. These steps are necessary to strengthen, regulate and enhance an accelerated harmonious, equitable and sustained economic development among the member states (Kuuteesa, 2012).

In progress towards a monetary union, the EAC managed to launch a customs union in

2005 and established a common market in 2010 as was envisaged in the 1999 treaty. To address the trade imbalances that were previously experienced and that led to the collapse of the earlier EAC, the countries resolved to apply the principle of asymmetry in the elimination of internal tariff. Within the framework, goods from Uganda and Tanzania were to enter Kenya duty free while the two countries were to impose a tariff at reducing rates on selected imports from Kenya for five years from 2005 (Ouma, 2016). The customs union and the common market already established have continued to pave way for free movement of goods and services, and labour within the region thereby enhancing intra-regional trade (Drummond *et al.*, 2015).

The convergence towards a monetary union is grounded in the Optimum Currency Area (OCA) theory (ECA, 2018). The theory stipulates that economies with similar structures have greater benefits in being members of currency unions and it sets the criteria to be met before integrating economies form a monetary union. Macroeconomic convergence is necessary in the formation of a monetary union. According to ECA (2018), various economic blocks have adopted convergence criteria similar to those of EMU but with varying targets on macroeconomic variables.

The EAC member countries adopted criteria for convergence towards a monetary union in line with EMU in 2007 (ECA, 2012). The criteria acted as a guide and set the conditions that each member country was to fulfill before the formation of the monetary union in 2015. One of the preconditions for monetary unification is the macroeconomic

convergence (Kuutesa, 2012). The convergence criteria adopted by EAC set three different stages within which macroeconomic convergence should occur. The first two stages were divided into primary and secondary criterion while the third stage was the introduction of a single currency (ECA, 2012). Table 1.1 summarizes the stages, set targets and the timelines for a successful formation of a monetary union in EAC.

Table 1. 1: Macroeconomic Convergence criteria in the EAC Monetary Union

Criteria	Indicator	Stage		
		Stage 1: 2007-2010	**Stage 2: 2011-2014**	**Stage 3: 2015**
Primary criteria	Budget deficit to GDP ratio; Excluding grants Including grants	 <6% ≤3%	 ≤5% ≤2%	Introduction of a single Currency, but this has been postponed to 2023
	Inflation rate	≤5%	≤5%	
	External reserves	≥4 months import cover	≥6 months import cover	
Secondary criteria	Real exchange rates	Stable	Stable	
	Interest rates	Market based	Market based	
	Real GDP growth	≥7%	≥7%	
	National Savings to GDP ratio	≥20%	≥20%	
	Current account deficit (excluding grants)	Consistent with Debt sustainability	Consistent with debt sustainability	
	Banking supervision and regulations payment and settlement system	Implementation and adhere to 25 core principles for systematically Important systems		

Source: (ECA, 2012, p.49)

From Table 1.1, the primary targets are budget deficit to GDP ratio (excluding grants) of less than six per cent, achievement of a single digit inflation rate of not more than five per cent, and maintenance of external reserves to cover at least four months of import cover. These targets were supposed to be realized by 2010. The secondary convergence targets specified to complement the primary ones are real GDP growth rates of not less than seven per cent, national savings to GDP ratio of greater than or equal to 20 per cent, stable real exchange rates, reduction of current account deficit (excluding grants) consistent with debt sustainability and adherence to sound bank supervision and regulations payment as well as efficient settlement system. The first and second stage targets for both primary and secondary criteria were to be achieved by 2014 to pave way for the launch of a single currency in the year 2015.

The OCA theory identifies macroeconomic convergence and business cycle synchronization as the main criteria for the formation of a monetary union (Kappel, 2015). Macroeconomic convergence of member countries is vital for the sustainability of a monetary union over the long term (Buigut, 2011; Bagumhe, 2013). It is, therefore, necessary to ensure that the pre-conditions for forming the EAMU are adequate. This entails making sure that economic, political, and institutional requirements are in place, since long term benefits are likely to be less visible than short-run costs (Durevall, 2011). Based on this framework, every member state should strive to achieve these targets for a successful EAMU (Kuteesa, 2012).

Business cycle synchronization and similar economic structure are necessary conditions for an optimal monetary union according to the OCA theory (Botto, 2018). The more aligned the business cycles of members of a monetary union are, the easier for the central bank to conduct stabilization policies (Belke, Domnick & Gros, 2017). According to Botto (2018), a unified monetary policy is not optimal if parts of a monetary union are experiencing expansion while other areas are going through recession. If union member states' economies are not synchronized, then different policies would be required to bring the major economic indicators in these economies on the optimal path (Kovacic & Vilotic, 2017). High degree of harmonization between national cycles will thus reduce the probability of asymmetric shock transmission across union members making the monetary union stable.

The cost of giving up autonomy over monetary policy is especially high if business cycles of member countries forming a monetary union are weakly correlated and alternative adjustment mechanisms, such as factor mobility are not adequately available (Bayoumi & Eichengreen,1998). Therefore, the higher the synchronization of business cycle among member states of a monetary union, the lower the cost of abandoning national monetary policy.

To help EAC converge to the set targets, the community envisaged to put in place an institutional framework for coordination of the activities of all the member states. Among the institutions that were to be established was the East African Central Bank (EACB)

whose mandate was to ensure price stability (Drummond *et al*., 2015). Other institutions include; East African Monetary Institute (EAMI), East African Statistics Bureau, East African Financial Services Commission and East African Surveillance, Compliance and Enforcement Commission (Republic of Kenya, 2018).

The regional bloc has put in place institutions along the line of the EU, to give policy direction, implementation and monitoring of EAC's convergence criteria. These institutions include: summit, council of Ministers, coordination committee, sectoral committees, East African court of justice, East African legislative assembly and secretariat (Mwasha, 2011). The institutions that were created for coordination were supposed to steer the convergence in a coordinated approach (Durevall, 2011). As observed by Durevall (2011), with the institutions in place and functioning, the regional bloc hoped to have prevailed the earlier challenge of lack of coordination that had been encountered in the past and was the cause of the collapse of the first EAC.

1.1.2 Performance of EAC Countries on Macroeconomic Convergence Criteria

A review of macroeconomic convergence criteria in EAC reveals significant variation by countries in achieving the set benchmark. The performance of EAC member states with respect to the set macroeconomic convergence criteria is summarized by Figures 1.1 to 1.6. The figures represent the performance of each country against the set targets. Figure 1.1 illustrates the inflation rates of the countries against the set ceiling of not more than five per cent per annum.

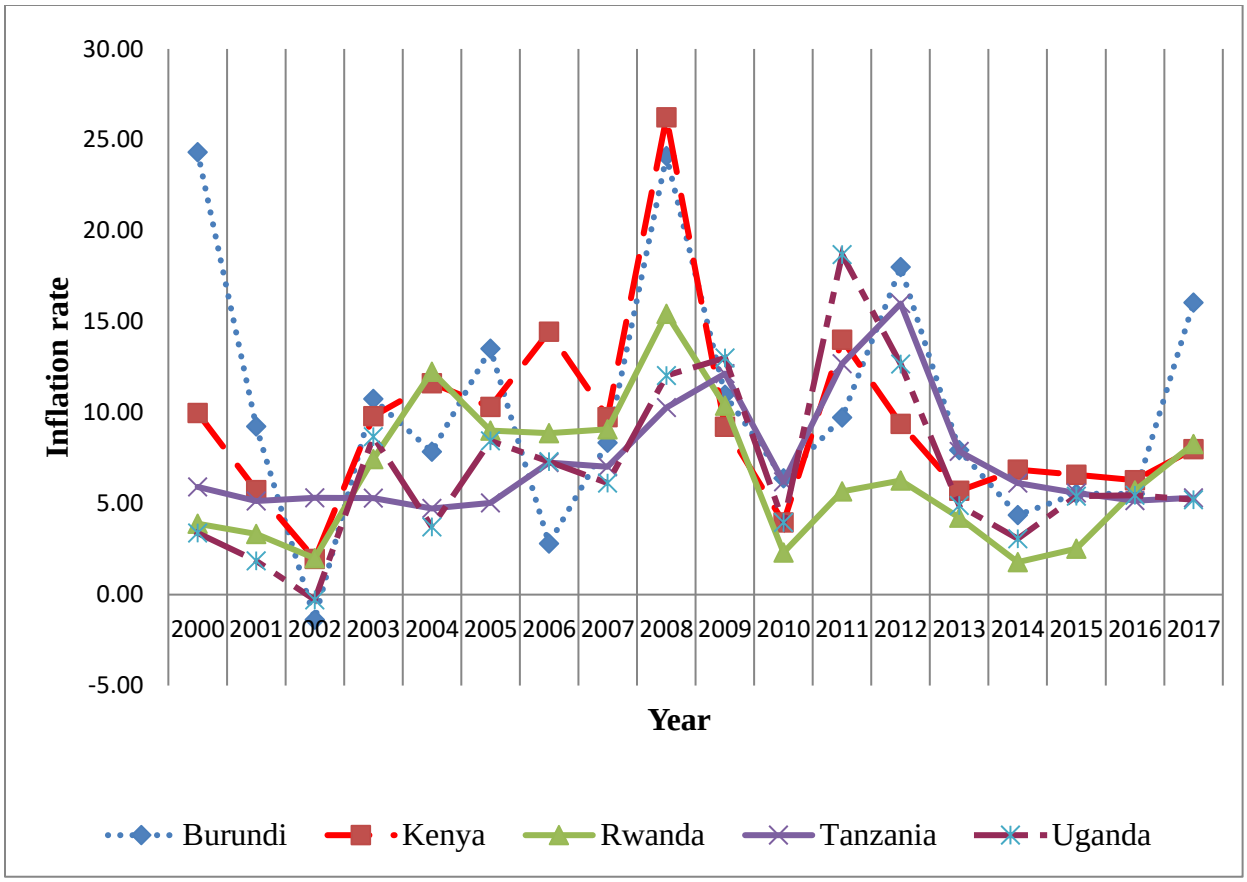

Figure 1. 1: Trend of inflation rates in Kenya

Source of data: World Bank (2017).

Figure 1.1 shows varying trends in inflation rates among EAC member states. The attainment of these targets has been elusive for most of the EAC member states. All the EAC countries had on average inflation rates above the set target. Rwanda had the lowest inflation rate averaging 6.6 per cent while Burundi exhibited the highest inflation rate averaging 10.2 per cent between 2000 and 2017. Kenya and Tanzania achieved an inflation rate of less than five per cent only once in 2002 and 2004, respectively. Burundi achieved the target in 2006 and 2014, Rwanda in 2000 to 2002 and 2010 while Uganda achieved the target in 2000 to 2002,

2004,2010, 2013 and 2014. The inflation rates in these countries have exhibited more or less similar trends since 2000. The difference in inflation among the countries is a pointer to differences in economic policies adopted by member states. The OCA theory specifies that countries envisaging a monetary union should have similar inflation patterns. Though EAC member states are exhibiting similar pattern in inflation rate, only Rwanda managed to attain a less than five per cent inflation rate in 2013 to 2015 after which it exhibited an upward trajectory. Figure 1.2 shows the annual GDP growth of EAC member countries between 2000 and 2016.

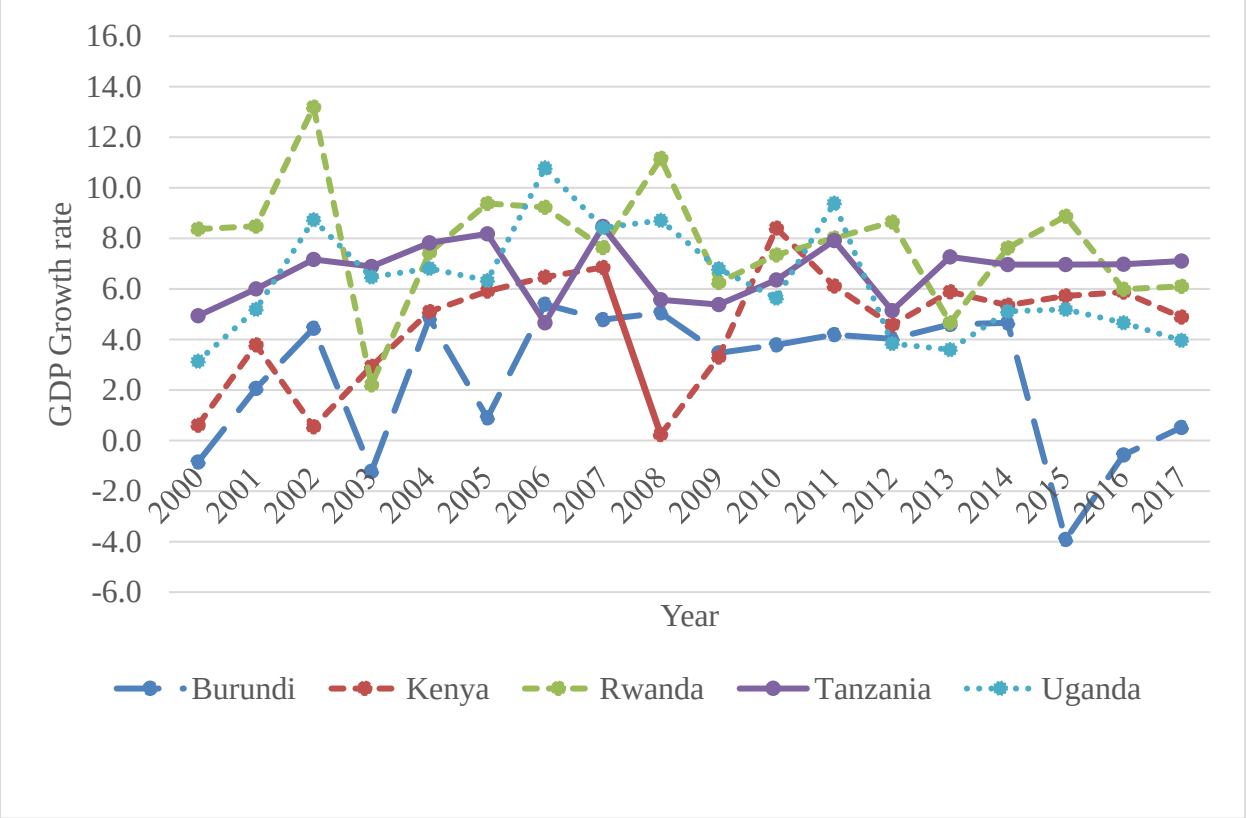

Figure 1. 2: GDP growth rates in EAC

Source of Data: World Bank (2017).

Figure 1.2 shows the GDP growth rates among the EAC member states. The convergence criteria specify that member states should register a GDP growth rate of more than seven per cent per year. However, GDP growth has been varying widely among EAC member states. Over the period 2000 - 2017, Rwanda has had relatively stable growth rate averaging 7.8 per cent over the period which is above the target. Tanzania and Uganda grew at an average of 6.7 and 6.3 per cent per year, respectively which is slightly below the target. Kenya and Burundi have had GDP growth rate of below the set criteria growing at an average rate of 4.6 and 2.6 per annum, respectively. Again, this might be due to varying monetary and exchange rate policies pursued by member states. This implies that the countries might not be working towards a common fiscal policy (Balogun, 2007). Figure 1.3 summarizes the performance of countries against the set target of budget deficit to GDP ratio in stage one and two.

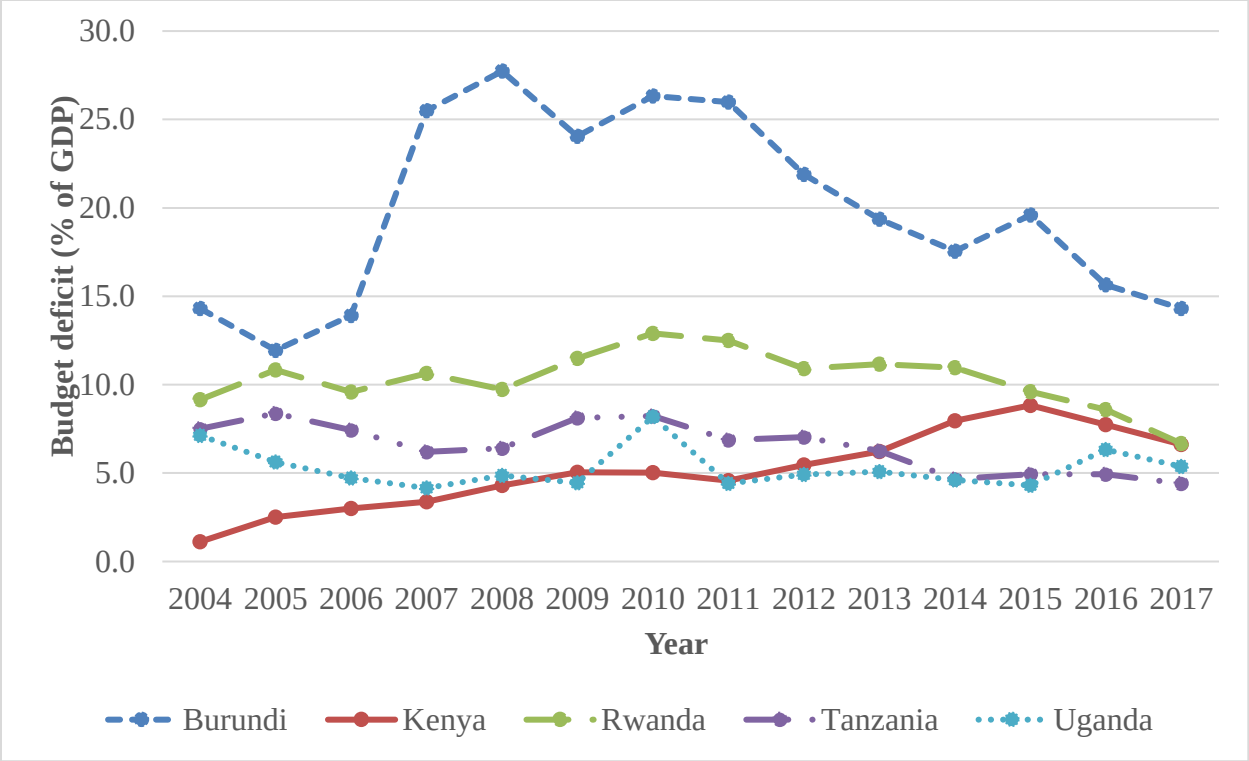

Figure 1. 3: Budget deficit to GDP ratio excluding grants for EAC

Source: World Bank (2017)

As illustrated in Figure 1.3, most of the EAC countries were unable to achieve the budget deficit to GDP ratio excluding grants criterion of less than five per cent. Only Tanzania and Kenya were able to meet the set target in 2000 to 2003. The countries are presumed to have gone through the first and second stages of the convergence criteria implementation. The implication is that all the countries should have attained a fiscal deficit to GDP ratio excluding grants target of less than five per cent. However, their performance indicates that all the countries have had difficulties in achieving the set target. Only Tanzania was able to achieve this target only in 2013. On average, the EAC member countries operated a

budget deficit as a ratio to GDP excluding grants of six per cent which is above the set target of less than five per cent. Figure 1.4 summarizes the performance of EAC member states on budget deficit including grants as a percentage of GDP.

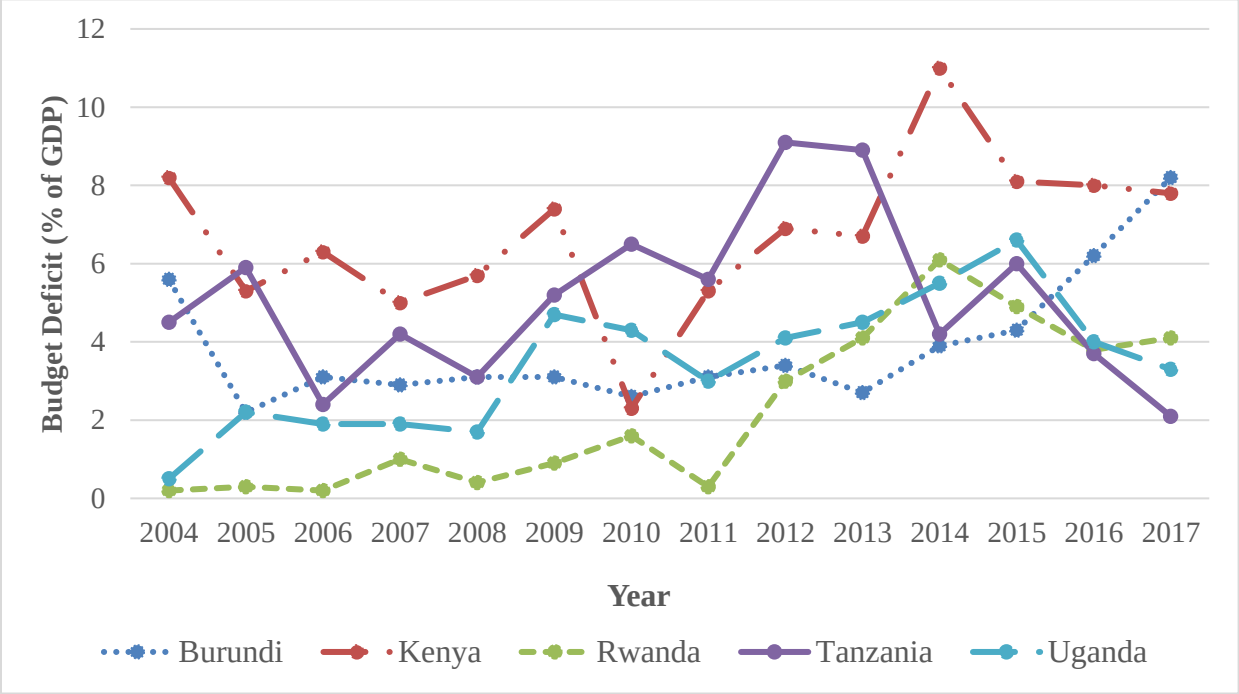

Figure 1. 4: Budget deficit to GDP ratio including grants for EAC

Source of Data: World Bank (2017)

Regarding budget deficit including grants, the EAC member countries were not able to achieve the target of less than two per cent per annum. Kenya, Tanzania and Rwanda managed to achieve the target between 2000 and 2003 while Uganda achieved the target between 2004 and 2008. From 2011 to 2018, the countries drifted away from the target and deviated both for stage one and two. During this period, the countries

operated a budget deficit to GDP ratio that averaged four per cent per annum that was well above the set target. This indicates that the countries' capacity to generate their own revenues is low compared to their financial demands. The high dependence on grants or aid for economic development is risky for economies envisaging formation of a monetary union (Geda & Kebret, 2008). Figure 1.5 summarizes the trend in interest rate volatility among EAC member states.

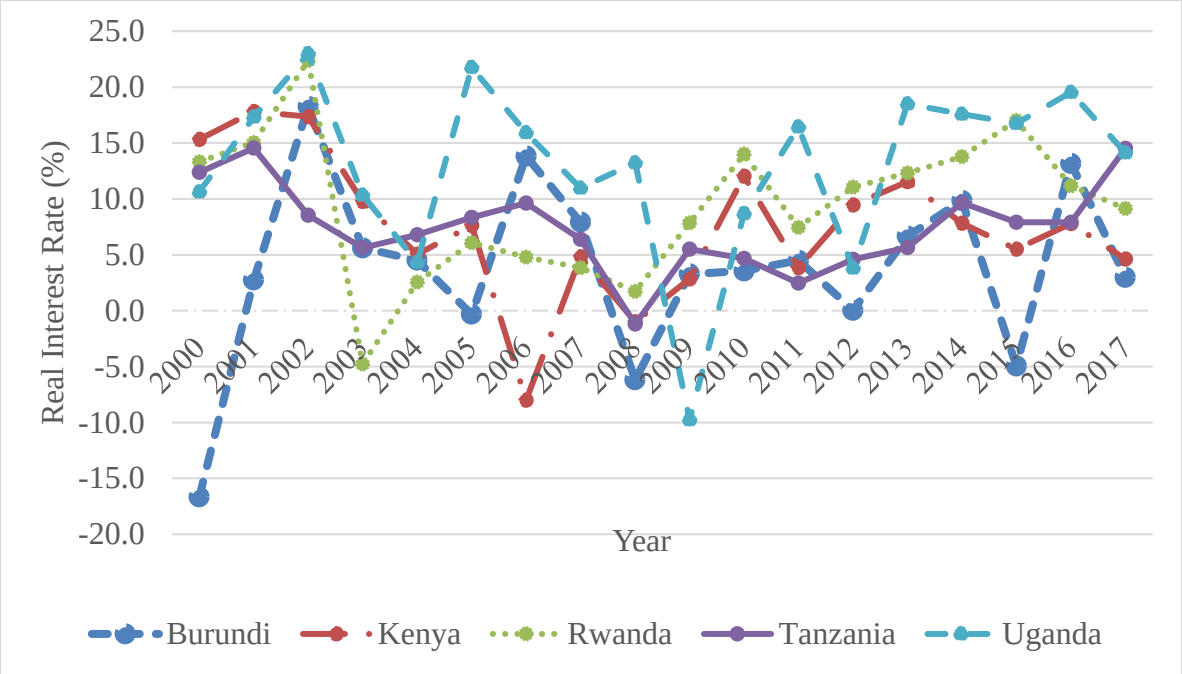

Figure 1. 5: Trends in interest rate among EAC member states

Source of Data: World Bank (2017)

Figure 1.5 exhibits differing interest rates among EAC countries. The real interest rates for EAC member states have been volatile, but the maintenance of market-based interest rate has been achieved. The interest rates offer the best indication of economic integration.

According to Buigut (2011), the convergence of interest rates is necessary to ensure a single monetary policy is optimal for all the member countries. The formation of a monetary union with differing rates of interest might be costly to some countries within the economic bloc making it undesirable. The divergence of interest rates would distort the flow of investments between member countries (Enoch & Krueger, 2010). Similarity of interest rates and exchange rates enhances financial integration thus reducing the necessity for exchange rate adjustments (Papiashvili, 2009). According to Papiashvili (2009), reduced exchange rate differences facilitates the financing of external imbalances with no adverse effects on capital inflows. Figure 1.6 summarizes the countries performance on gross national savings as a percentage of GDP.

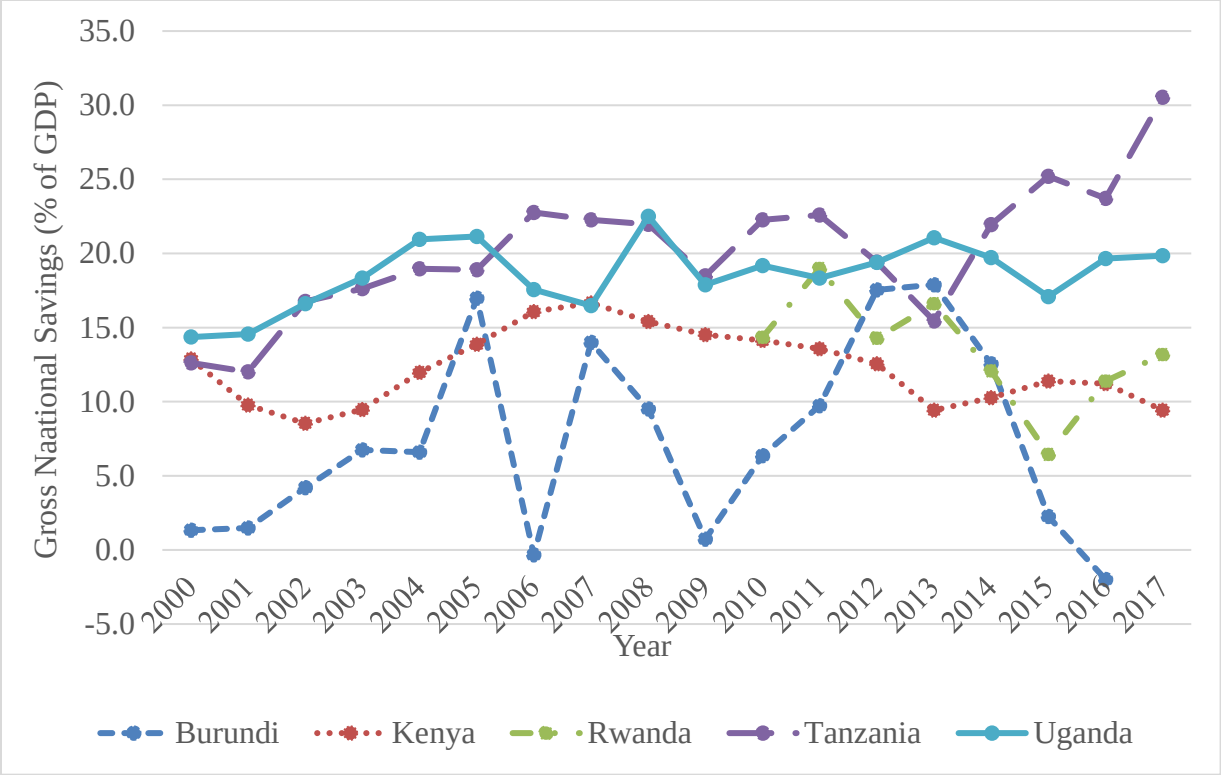

Figure 1. 6: Gross savings to GDP ratio for EAC countries

Source of Data: World Bank (2017)

Figure 1.6 shows that EAC member countries have not been able to achieve the target which required member states to maintain national saving as a percentage of GDP of at least 20 percent. Only Tanzania managed to meet the target in some years but the performance is not stable depicting fluctuations. Meeting the national savings target is crucial in that it encourages fiscal discipline and also reduces the risk of countries with low saving capacities taking funds from those with higher capacity for saving. Any attempt to borrow, will increase the budget deficit. The excessive public debt of individual economies poses an increased risk to the entire monetary union (Tokarski, 2019).

An assessment of macroeconomic convergence in EAC shows that while some progress has been made, performance is generally below the targets as set out in the convergence criteria. The countries in the EMU had to meet the prescribed macroeconomic convergence benchmarks called Maastricht convergence criteria before they were allowed to join the monetary union (De Grauwe, 2018). The performance of EAC countries indicates that the progress made towards formation of a monetary union is not sufficient thereby posing a risk to the establishment of the monetary union.

The progress of the countries in aligning their economies to the set macroeconomic convergence criteria is low. For example, the compliance with the fiscal deficit criterion of three per cent of GDP (including grants) has been challenging for most of the EAC Partner States, particularly Kenya, Burundi and Tanzania. Failure to meet the set macroeconomic convergence criterion might be attributable to differences in their economic structure, social and institutional mechanisms. As a result, questions have emerged about the countries' readiness to form a monetary union within the agreed time frame, especially in light of slow implementation of common market elements such as free mobility of labor, capital, and goods (Mafusire & Brixiova, 2012). The hindrances to the mobility of labour would also inhibit production and economic growth limiting the progress in convergence.

1.2 Statement of the Problem

The world economies have resorted to economic and monetary integration due to the frustrations resulting from the sluggish trade negotiations under the WTO (Zahrnt, 2005).

The pursuit by EAC to form a monetary union is to maintain monetary and fiscal stability aimed at strengthening sustainable economic growth and development of the member countries (ECA, 2018). Economic integration in EAC is also seen as a mechanism for addressing growth and developmental challenges that the countries are experiencing (ECA, 2010). It is, therefore, expected that member countries will become prosperous, competitive, stable, secure and politically united as a result of monetary unification (Waffubwa, 2014). The end result is improved quality of life for the citizens of the member countries through improved investment and increased production.

The EAC member countries have put macroeconomic convergence criteria as a precondition to the formation of a monetary union. The pre-requisite conditions established for the formation of EAMU include harmonization of fiscal, monetary and exchange rate policies (ECA, 2018). Each member country was required to achieve set macroeconomic targets by 2015. However, a review of macroeconomic performance of the EAC countries reveal significant variations in the achievement of the set criteria. Furthermore, there is no country within EAC that has been able to achieve the targets. On average, between 2000 and 2018, the GDP growth rate was 5.6 per cent while budget deficit including grants averaged six per cent against a target of over seven per cent and less than three per cent, respectively in EAC member states. Failure by the EAC member countries to achieve the set macroeconomic targets has raised questions on the readiness of the regional community to proceed with the arrangement of forming a monetary union (Mafusire & Brixiova, 2012).

To steer the process of integration, the community has put in place an institutional framework to avoid the challenges that led to the collapse of the first EAC (Durevall, 2011). Among the institutions created is the EAC secretariat, which is the executive arm of the community tasked with the implementation of protocols and agreements entered into. Despite these efforts, the community failed to establish the monetary union in 2015 as was envisaged. Instead, the member countries signed the EAMU protocol extending the establishment of a monetary union to 2023. Based on the foregoing, this study therefore, seeks to establish empirical evidence on the readiness of the EAC to have a monetary union in place to benefit from economic stability and prosperity under a deeper integration.

A number of studies on economic integration in East Africa have been conducted. Mkenda (2011) and Mafusire and Brixiova (2012) studied macroeconomic shock synchronization using real GDP and inflation rates in EAC to establish whether EAC constituted an Optimum Currency Area. Buigut (2011) used multivariate cointegration of inflation rates, monetary base and real GDP to establish whether a fast-tracked EAMU would be beneficial. Githuku et al., (2018) studied income convergence and business cycles synchronization in EAC employing Autoregressive Distributed Lag (ARDL) model and correlation analysis. However, these studies have not considered the convergence of all macroeconomic variables such as exchange rates, interest rates and budget deficit as outlined in the criteria for formation of a monetary union. If some macroeconomic variables are not converging, the monetary union might have higher costs than the benefits. The study also deviates from these studies by including policy variables such as

government effectiveness and political instability as factors affecting macroeconomic convergence in EAC.

1.3 Research Questions

The study was guided by the following questions:

(i) What is the state of growth convergence among EAC member countries?

(ii) What is the state of convergence of monetary variables in the EAC member countries?

(iii) What is the state of convergence of fiscal variable in EAC member countries?

(iv) How synchronized are business cycles in EAC countries?

1.4 Research Objectives

The overall objective of the study was to analyze macroeconomic convergence and business cycles synchronization towards monetary union in East African community. The specific objectives of the study were to:

(i) Establish the state of growth convergence among EAC member countries.

(ii) Evaluate the state of convergence of monetary variables in the EAC member countries.

(iii) Examine the state of convergence of fiscal variable in EAC member countries.

(iv) Analyze the synchronization of business cycles in EAC countries.

1.5 Significance of the Study

The study contributes to existing literature on regional economic integration in the EAC region. The study is useful in assisting the respective countries through the relevant ministries to formulate policies geared towards successful implementation of the EAMU protocol thereby leading to reaping the benefits of the monetary union.

The study is also useful in guiding the EAC countries in developing appropriate trade policies that will exploit the opportunities created by the economic integration. By establishing the state of convergence, the study enables the respective member countries through the ministries responsible for finance and planning as well as the respective central banks to develop policies towards enhanced productivity for macroeconomic stability and exchange rate stability. Lastly, the study is beneficial to the academicians by providing insight into the OCA theory as well as growth theories.

1.6 Scope of the Study

This study seeks to assess macroeconomic convergence and business cycles synchronization in East African Community member countries. The study covers the five EAC member countries of Kenya, Uganda, Tanzania, Rwanda and Burundi. South Sudan was not included in the study because it might not have had time to align its macroeconomic variables towards the convergence criteria. This is because the country joined EAC in April 2016, and therefore, was not a member for the larger part of the study period. The study makes use of time series and panel data covering the period 2000

to 2018. This period is significant since it coincides with when EAC was re-established.

1.7 Organization of the Study

The study is organized in five chapters. The first chapter presents background information of the study. It also highlights the research problem, research questions and objectives as well as the significance, scope and organization of the study. Chapter two looks at the relevant theoretical and empirical literature while chapter three explains the research design and methodology to be used. It also presents the empirical models that were estimated and data collection and estimation procedures that were used in the study. Chapter four provides the diagnostics and empirical findings together with the discussion. Chapter five presents the summary of the study, conclusion, policy implications and areas of further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter contains both the theoretical and empirical literature review. The chapter is divided into three sections in which the first section looks at theoretical literature, the second section reviews empirical literature and the last section gives an overview of reviewed literature.

2.2 Theoretical literature

Studies on income and exchange rate convergence and monetary integration have been anchored in a number of theories. The theories that have been advanced from time to time include the Optimum Currency Area (OCA) theory, the neoclassical growth theory and lately, the endogenous growth theory.

2.2.1 The Optimum Currency Area Theory

The Optimum Currency Area (OCA) postulates that there is an optimum geopolitical area which should share a currency. According to the theory, the geopolitical area does not necessarily correspond with national boundaries. The OCA theory has undergone several advancements which can broadly be categorized into two: the classical and the new OCA theory.

The classical view of the OCA theory was first advocated by Mundell in 1961 and further

advanced by McKinnon (1963) and Kenen (1969). Mundell (1961) identified labour mobility, price and wage flexibility as important factors to determine the eligibility of countries joining a monetary union. According to Mundell (1961), labour mobility is an effective tool to address challenges of unemployment between regions due to asymmetric shocks. In the absence of labour mobility, if the shocks emerge between two sub-regions of the same currency area, one region will face the problem of unemployment. Mundel (1961) also regarded wage flexibility as a mechanism to cope with idiosyncratic demand shocks. Therefore, the theory holds that if labour mobility or price and wage flexibility were present in a region, there would be no need for changes in its exchange rate (Broz, 2005).

McKinnon (1963) advanced the traditional theory by emphasizing on the degree of openness and size of the economy as crucial criteria for joining a currency union. McKinnon (1963) suggested that a country's trade behaviour is essential in determining optimality of the integration benefits. Specifically, as countries open up their economies, flexible exchange rates become less effective as a control device for external balance and at the same time more damaging to internal price-level stability (Putun, 2014).

Kenen (1969) further extended the traditional theory by introducing product diversification as an important criterion for formation of a common currency area. Kenen argued that labour mobility rarely existed, and therefore diversity in a nation's product mix, would be more relevant than labour mobility (Broz, 2005). Moreover, Kenen asserted that if a

country is not diversified and produces only one product which it exports, then if there was a negative demand shock affecting its exports, the economy's export revenue would fall. The fall in revenues could be offset by a flexible exchange rate because a fall in demand for export products would reduce the demand for domestic currency. This would cause a depreciation of the exchange rate which would improve export revenues. Kenen (1969) further argued that a well-diversified economy also has a diversified export sector. If each of the industries in the economy is to be subjected to some kind of a shock and those shocks are uncorrelated, a positive shock in one industry and a negative shock in another industry would result in the cancellation effect on the total export, making it more stable.

The new OCA theory was advanced by Tower and Willet (1976), Tavlas (1993) and Frankel and Rose (1998). They shifted focus towards the benefits of a common currency as opposed to the potential costs (Broz, 2005). The advancement introduced factors such as the degree of similarity of inflation rates, financial integration, effectiveness of monetary policy, credibility of monetary policy and high covariation in economic activities as the most relevant factors to be considered in the evaluation of the possibility of monetary union formation (Putun, 2014). Other factors considered included correlation and variation of shocks, character of shocks, effectiveness of exchange rate adjustments, labour market institutions, synchronization of business cycles and political factors as the most relevant factors in the evaluation of the possibility of monetary union formation (Broz, 2005).

The OCA theory has a number of limitations: (i) the lack of a standard measurement and

framework implying a possibility of different boarders for a monetary union using different OCA criteria; (ii) the problem of inconclusiveness (Tavlas, 1994) (iii) the difficulty in measuring political will which is a crucial factor in monetary union formation (Mkenda, 2001) and (iv) the failure to accommodate differences in the stages of development in the assessment of suitability of a monetary union. If countries are at different stages of economic development, a common monetary policy might not be optimal for all countries.

As observed by Dellas and Tavlas (2009), assuming a country with a high income per capita and another with a relatively low per capita income, the regional Central Bank would be expected to maintain price stability by adopting a common monetary policy that should produce optimal results for all participating economies. Suppose that an event occurs such that the relatively poor country loses competitiveness, for it to regain competitiveness it has to undergo a prolonged period of deflation. This is because devaluation is not a policy option for the regional Central Bank since it has to adopt a monetary policy that is optimal to all countries and not to respond to specific country disturbances.

2.2.2 Neo-classical Growth Theory

The neo-calssical growth theory was first advanced by Robert Solow and Trevor Swan in 1956 to explain the mechanisms through which an economy grows in the long-run. The theory postulates that long-run economic growth is the result of three factors; growth of labour, capital accumulation and technological progress given as:

$$Y_t = K_t^{\alpha}(A_tL_t)^{1-\alpha} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (2.1)$$

Where Y_t is total production, $A_t L_t$ is effective labour, t is time and $0 < \alpha < 1$ is the elasticity of output with respect to capital. The theory posits that the accumulation of capital within an economy, and how people use that capital is important for economic growth. While the economy has limited resources in terms of capital and labour, the theory holds that the contribution to growth from technology is boundless and that technology plays a role of augmenting labour productivity and increases the output capabilities of labour.

The theory assumes that the production function in equation (2.1) is homogenous of degree one. The implication is that the model exhibits constant returns to scale. The theory also assumes that both labour and capital are necessary in the production of the output with diminishing marginal returns in each of the inputs. The theory also asssumes a fixed level of technology at a given point in time. Thus though these conditions highlight the importance of labour and capital accumulation as a prerequisite for a firm's sustained growth, the level of technology which is exogenously determined must also grow. The theory assumes that all savings are invested and that savings are a constant proportion of output and that technological progress is exogenous.

Given these assumptions, the steady-state equilibrium of an economy can be analysed through the evolution of output per effective labour. Assuming no technological change, the evolution of capital-labour ratio can be written as (see Appendix A):

$$\dot{k}_t = sf(k_t) - (n + \delta)k_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.2)$$

This can be illustrated using a phase diagram figure 2.1

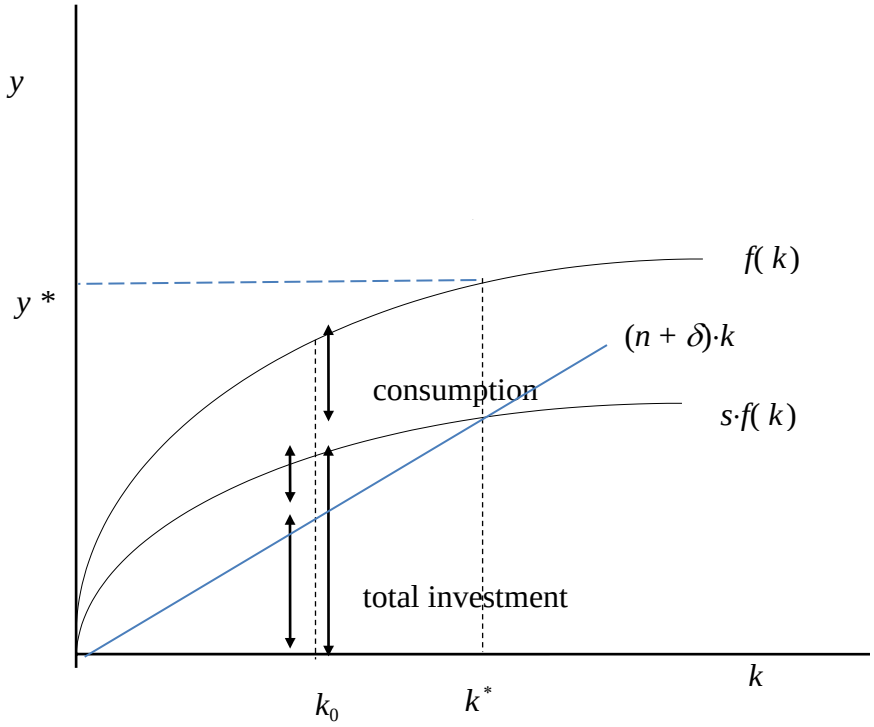

Figure 2. 1: The steady-state growth path

Source: Adapted from Njuguna (1999).

Figure 2.1 shows the path of an economy to its steady-state. The $f(k)$ and $sf(k)$ are production and investment functions, respectively with positive slope which indicates that output per worker increases at a diminishing rate as capital increases due to the law of diminishing returns. If an economy has initial capital stock per worker at (k_o) which is greater than zero, the savings per worker will exceed the investment required to keep the capital-labour ratio constant. Therefore (k) and (y) will increase until (k^*) is reached and the economy will be at its steady-state. At any point beyond (k^*), the savings per worker will be less than the investments required to keep the capital-labour ratio constant. Thus (y) will fall as (k) falls to (k^*) and the economy reaches the steady-state. (k^*) is, therefore,

a stable equilibrium value of the capital-labour ratio that maintains the steady-state of the economy.

According to the neoclassical growth theory, economies will converge in the long-run to their steady state equilibrium and permanent growth is achieved only through technological progress. Thus, growth rate of output in a regional economy is dependent on the growth in labour, technological progress and physical capital accumulation through investment expenditures. The theory therefore posits that growth disparities across regions occur not only due to differences in the growth of capital relative to labour, but also because of possible differences in technological progress. Persistent variations in rates of technological progress have the potential to accerelate or reduce the extent in which regions converge to each other. The implication of the theory is that poorer countries should grow faster and eventually catch-up with richer countries which is referred to as convergence.

2.2.3 The Endogenous Growth Theory

The Endogenous growth theory was developed by Paul Romer in 1986 and further advanced by Lucas (1988) and Romer (1990). It relaxed the assumption of exogenously determined technological progress of the neoclassical theory. The theory holds that economic growth is primarily the result of endogenous and not external forces. Endogenous growth theory did not simply criticize the neoclassical growth theory but rather, it introduced endogenous technical progress in the growth models. The theory postulates that investment in human capital, innovation and knowledge are significant contributors to

economic growth. Therefore, according to the theory, long-run growth rate is determined by technological progress which is driven by creativity and innovation.

The theory asserts that only investment in physical capital and human capital through education, research and development can affect economic growth. Therefore, improved education and indeed any kind of training and research that adds to human knowledge are necessary for economic growth. The endogenous growth theory views technological progress as a product of economic activity contrary to the neoclassical growth theories that treated technology as given. The theory believes that technological progress depends on economic decisions since it comes from industrial innovations made by profit seeking firms and this depends on funding of science and the accumulation of human capital. Thus, according to the theory, the long-run growth rate of an economy depends on policy measures such as subsidies for research and development or education which increases the incentive for innovation.

The theory also holds that unlike physical objects, knowledge and technology are characterized by increasing returns, and these increasing returns drive the process of growth (Cortright, 2001). The implication therefore is that because of national differences in investment in education, research and extension, income differentials between countries may be persistent. The differences in human capital acquired through the active pursuit of learning or education and through the act of production itself or learning by doing, is a major contributing factor of growth in countries or regions (Almendarez, 2013). The theory

considers technological development not a random phenomenon regulated by the free market operations. To a great extent, economic growth of countries and regions is the result of designed development policies and social capabilities of the country, and the ability of the regions to organize their institutions that stimulate the creation and the broadest diffusion of technological change.

Lucas (1988) extended the Romer (1986) model by incorporating human capital in the growth function. According to Lucas (1988), investment in education leads to the production of human capital which is a crucial determinant in the growth process. Lucas (1988) makes a distinction between the internal effects of human capital where the individual worker undergoing training becomes more productive, and external effects, which spillover and increase the productivity of capital and of other workers in the economy. It is investment in human capital rather than physical capital that has spillover effects that increase the level of technology (Mishra, 2016).

The Lucas model has the output for firm i, take the form

$$Y_i = A(K_i)(H_i)(H_e) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 2.1$$

Where A, is the technical coefficient, K_i and H_i are the inputs of physical and human capital used by firm i to produce good Y_i. The variable H is the economy's average level of human capital. The parameter e, represents the strength of the external effects from human capital to each firm's productivity.

According to Lucas (1988), a firm faces constant returns to scale, while there are increasing returns for the whole economy. Further, learning by doing or on-the-job training and spillover effects involve human capital. Each firm benefits from the average level of human capital in the economy. Thus, it is not the accumulated knowledge or experience of other firms but the average level of skills and knowledge in the economy that are crucial for economic growth. The main criticism of this theory is its failure to explain conditional convergence (Sachs & Warner, 1997).

2.3 Empirical literature

Tjirongo (1995) evaluated Namibia's suitability of being a member of a Common Monetary Area (CMA) by assessing the costs and benefits of its membership and the instruments that could be used to address asymmetric shocks. The study employed panel data for the period 1980 to 1994 on variables which included factor mobility, openness of the economy to trade and the degree of diversification. The study established that given the relative size of the Namibian economy versus South Africa, the degree of openness to foreign trade and the high degree of capital mobility, the use of the nominal exchange rate as an instrument of economic policy would have limited effects. Regarding the benefits and costs of Namibia's membership to the CMA, the study established that membership to the CMA could bring about positive net benefits due to the long-term benefits of price stability, and also, it helps to enhance the reputation of economic policy management. These could in turn promote macroeconomic stability and thus beneficial for Namibia to remain within the CMA.

Bergman (1999) studied whether monetary unions made sense using the Scandinavian Currency Union (SCU). The study used OCA theory to examine whether the countries which formed SCU, namely Denmark, Norway and Sweden, constituted an OCA. The study used panel data to estimate a structural VAR model to examine the symmetry of country-specific structural shocks in each of the three countries. The study used output growth, money growth, inflation and interest rates as the variables. The study found that country-specific structural shocks in the SCU members were not highly symmetric during the union period. Given these findings, the study concluded that the three Scandinavian countries did not form an optimum currency area.

Jonung and Sjöholm (1999) studied whether Finland and Sweden should form a monetary union with each other, and with the rest of Europe. The study used panel data for the period 1980 to 1987 and employed a simple correlation analysis. The study evaluated the OCA criteria and it divided the criteria into two: country-specific criteria and union-specific criteria. The country-specific criteria evaluated the degree of wage flexibility and the degree of product diversification. The study found that the degree of wage flexibility was rather low in Finland and Sweden and that both Sweden and Finland exhibited a low degree of product diversification. The study also established that both Finland and Sweden were not obvious candidates for the membership of EMU.

Mkenda (2001) undertook a study to find out whether EAC constituted an OCA. The study used panel data for the period 1981 to 1998 and employed the Generalized Purchasing

Power Parity methodology. The study established that real exchange rates of the three EAC countries were co-integrated. Therefore, they were likely to be affected by similar shocks. As a result, the countries were better candidates for a currency union. The study also utilized a number of factors deemed to be important in assessing whether a group of countries or a region could form a currency union. These factors included the degree of product similarity, degree of openness, cyclical covariation in economic activity, similarity in industrial structure and similarity in inflation. The study concluded that the economies exhibited dissimilarity in most of the factors and, therefore, not suitable for monetary Union.

Buigut and Valev (2005) empirically assessed the suitability of the East African countries to form a monetary union by testing for symmetry of the underlying structural shocks. The study used panel data for the period 1970 to 2001. Further, the study employed a two variable Structural VAR model to determine whether these countries were good candidates for a monetary union. They investigated the asymmetric shocks of the member countries through the demand and supply shocks. The results from the study concluded that demand and supply shocks were asymmetric in the EAC and, therefore, do not support the creation of a monetary union. The study concluded that since the speed and magnitude of the adjustment to shocks was similar across the countries in EAC, further integration of the economies might lead to more favourable conditions for a monetary union.

Hammouda *et al.* (2007) carried out a study on whether macroeconomic convergence led

to growth in various African RECs. The study used panel data from a number of RECs with varying time periods and used inflation and fiscal balance as variables to test for convergence. A number of methods were employed in the study. These include sigma convergence test or the analysis of cross-country dispersion, a unit root test on the difference of the series and regional mean, and a cointegration test. The study found out that though there seemed to have evidence of the tendency of macroeconomic convergence in the various African RECs, it did not translate to higher economic growth as was expected.

Hammouda *et al.* (2009) undertook a study on why regional integration does not improve income convergence in Africa. The study employed panel data from 1981 to 2000 for 20 countries in Africa. The study used various techniques including absolute, conditional and sigma convergence as well as cointegration analysis. The study found low income convergence that was associated with slow output growth in many African countries, the slow accumulation of factors of production and low factor productivity due to inefficient production technology. Failure to improve intra-regional trade, intra-regional investments and low labour mobility was also linked to the slow income convergence of the African RECS. The study also established that the constrained capital accumulation as a result of limited inflow of FDI was also a factor that contributed to the low-income convergence in these countries.

Ramos *et al*. (2010) analyzed the differential impact of human capital on regional

productivity and convergence in Spanish regions. The study applied spatial panel data techniques for the period 1980 to 2007 and employed maximum likelihood procedure in the estimation. The study used different levels of schooling as a measure of differences in human capital. The study findings confirmed positive impact of human capital on regional productivity and convergence, but revealed no evidence of any positive geographical spillovers of human capital. The study also established that the composition of human capital improved regional productivity and growth within the study area. The study found that tertiary and secondary level of education had a significant and positive effect on productivity and growth. In addition, the study established that primary level of education had no effect on productivity and growth.

Dramani (2010) analyzed economic convergence in the Franc zone countries in Africa. Specifically, the study tested convergence of the economies of the West African Economic and Monetary Union (WAEMU) and Economic and Monetary Community of Central Africa (CEMAC) zones. The study utilized both cross-sectional and panel data spanning for the period 1970-2000 using variables which included per-capita income, inflation rate, ratio of outstanding debt to GDP and the ratio of current external balance to GDP. The study found that the convergence process, and hence that of integration, had not been carried out uniformly in the Franc Zone countries. Rather, the process had been given greater emphasis in WAEMU than in CEMAC Zone. Further, the study found a period-related convergence in the cotton-producing countries, coffee-producing countries and coastal countries. This showed that the hypothesis of a common convergence path in the

Franc Zone had not been borne out by the study. The study concluded that the analysis of spatial effects had brought to the fore the existence of inhibitor effects on the convergence speed. Taking border effects into account contributed to reducing the convergence speed by half on average over the post-devaluation period, and by one-fifth over the structural adjustment period.

Szeles and Marinescu (2010) undertook a study on real convergence in Central and Eastern European (CEE) countries. The study utilized panel data for the period 1998 to 2009 for ten CEE countries and employed GMM technique of analysis. The study established that there was empirical evidence of both absolute and conditional convergence. The study used trade openness, inflation rate, government debt, gross capital formation, household final consumption, labour productivity, exchange rate and population growth as control variables for conditional convergence. The conclusion of the study was that trade openness, labour productivity and exchange rate were the main drivers of regional growth in the CEE region.

The study conducted by Debrun, Pattillo and Masson (2011) investigated whether African monetary unions should be expanded. The study investigated business cycles correlation and synchronization by undertaking a cost-benefit analysis of monetary integration and applied it to some currency union in Africa, including EAMU. The study utilized panel data for the period 1990 to 2007. It found that an average correlation in terms of trade for EAC member states was higher than those of West Africa Economic and Monetary Union

(WAEMU) and Common Monetary Area (CMA) in South Africa.

Buigut (2011) undertook a study to determine whether EAC member countries would form a successful monetary union. The study employed a multivariate cointegration framework to analyze co-movement behavior of nominal exchange rates, real exchange rates, inflation rates, monetary base and real GDP for the five countries using quarterly panel data from 1997-2008. The study established only partial convergence for the variables considered. This suggested there could be substantial costs for the member countries from a fast-tracked process of EAMU formation. The implication was that EAC countries needed significant adjustments to align their monetary policies and to allow a period of monetary policy coordination to foster convergence. This would improve the chances of a sustainable currency union.

Sheikh, Azam, Rabby, Alam and Khan (2011) undertook a study on monetary union for the development process in EAC. The study utilized panel data for the period 1980 to 2010 and used business cycle synchronization approach. It considered cross country correlation analysis and analysis of variance technique to examine whether EAC countries are characterized by synchronized business cycles or not. The study results showed that except Rwanda, the EAC countries exhibited similar pattern of business cycle and trend. It found that there exists a feasibility of a monetary union in EAC. The study concluded that these countries, except Rwanda, do not differ significantly in transitory or cycle components but do differ in permanent components especially in growth trend. This suggested that costs of

forming a monetary union in EAC would be less than the benefits making EAMU feasible. The costs of Rwanda participation in EAMU would be higher than the benefits.

Mafusire and Brixiova (2012) examined the macroeconomic shock synchronization in EAC. The research made use of annual data on real GDP and inflation rates from five EAC countries for the period 1980 to 2009. The study employed the OCA theory and structural VAR to analyze the extent of the shock synchronization among the EAC countries. It established that the degree of shock synchronization of economic shocks between EAC countries was low. The low macroeconomic convergence affirms the need not to hurry the transition towards EAMU. It concluded that there was need to put in place harmonized macroeconomic policies that would raise synchronization of business cycles before the monetary union is established.

Ramos, Suranach and Artis (2012) conducted a study on the link between human capital and regional economic growth in the EU. The study analyzed the effect of over-educated workers on regional economic growth in EU using panel data for the period 1995 to 2005. The variables that were used in the study included GDP per capita and different levels of education as a measure of human capital. Generalized method of moments estimation technique was used to estimate the panel data models. The study found that there was a significant correlation between over-education and regional economic performance in the EU. It concluded that qualified workers are more productive at the aggregate level than the unqualified ones and thus regions with higher levels of human capital can expect higher

growth rates than regions with low levels of human capital.

Péridy, Hazem and Brunetto (2013) undertook an analysis of real convergence in MENA countries' regional areas for more than eight hundred disaggregated areas. The study used panel data of 10 MENA countries and employed spatial panel data econometric model of conditional beta-convergence. The variables investigated included the per-capita income, trade openness, transport and infrastructure, distance and temperature and precipitation were used as control variables for convergence. The finding was that with the exception of Egypt and Morocco, the MENA countries were converging. However, the convergence was slow and regional inequalities remained considerable in these countries. The speed of convergence was estimated to be three per cent and the half time period necessary to reach the steady state was equal to 25.5 years. The study further established that climate change was likely to have detrimental effects on real income and may delay convergence process.

Asongu (2014) evaluated whether the proposed African monetary unions were optimal currency areas by analyzing real growth, monetary and fiscal policy convergence. The study used panel data for the period 1980 to 2008 in overlapping two-year intervals. Further, the study employed a two-step GMM estimation technique to establish whether there was real GDP, monetary and fiscal policy convergence in the African RECs. The variables that were investigated included trade openness, public investments, GDP growth, inflation rate and financial size. The study findings showed lack of convergence that was attributed to institutional cross-country differences, absence of fiscal policy convergence

and lack of potential for eliminating idiosyncratic fiscal shocks due to business cycle incoherence. The study concluded that the member states needed to ensure that the cross-country differences in structural and institutional characteristics that hampered the effectiveness of convergence in monetary, real GDP and fiscal policies were harmonized.

Kappel (2015) did a comparative study on business cycles synchronization in the Euro area and some potential monetary unions particularly MERCOSUR and NAFTA. The study employed three methods of evaluating business cycle synchronization. These methods included analyzing correlations of cyclical components of GDP, the construction of synchronization index based on concordance's output gaps synchronicity calculations, and the derivation of similarity index to measure the similarity of output gaps. The study used quarterly panel data from first quarter of 1995 to fourth quarter of 2013. Based on the findings, the countries which entered the Euro area at first including Germany, Netherlands, Austria, Finland and France had a higher synchronization of business cycles. The implication was that these countries were better candidates for a monetary union. The study established that the countries which entered the Euro area later including Slovakia, Italy and Greece had lower alignment of business cycles. This meant they were not ideal candidates for EMU. The study further found that NAFTA countries of Canada, Mexico and the USA were appropriate candidates for creating a monetary union since they had a higher level of synchronization of business cycles. However, MERCOSUR states were not prepared for a monetary union according to OCA since they exhibited a lower level of business cycles synchronization.

Schaffar and Péridy (2015) studied spatial convergence of Maghreb regional areas. The variable of concern in this study was the GDP per capita. The study used panel data from 1990 to 2005 and employed a non-parametric approach based on classical and spatial Markov chains. This approach investigates the long-term spatial associations between regional units. It established that Maghreb areas showed a significant trend of regional convergence in GDP per capita. The study also showed that there was an important spatial clustering process in these areas. According to the study, although almost 75 per cent of the areas seemed to converge towards a rather high GDP per capita level in the stationary state, 25 per cent found themselves trapped in a lower development trend which seemed to be spatially auto-correlated. This meant that in the Maghreb region, there was interdependence between regions in terms of GDP per capita growth.

Karanasos et al. (2016) carried out a study on inflation convergence in the EMU. The study used panel data for the period 1980-2013 and utilized inflation rate to test for convergence. Panel unit root test method was employed to analyze the convergence and the study found that some countries were in the process of converging absolutely or relatively. Further, by using a clustering algorithm, the study established three absolute convergence clubs in the pre-euro period comprising of early accession countries which included Luxembourg clusters with Austria and Belgium, while a second sub-group comprised of Germany and France and the third sub-group was formed by Netherlands and Finland.

Nakibullah (2017) studied state of shocks synchronization among the Gulf Cooperation

Council (GCC) member countries. Panel data for the period 1975 to 2014 was used in this study. The study employed a structural VAR to identify the structural shocks of demand and supply by including oil prices. The findings were that both supply and demand shocks were either negative or low signifying that the shocks were not synchronized. The implication of the findings was that the GCC countries would find it difficult to adjust supply and demand shocks if they form their aspired Gulf Monetary Union. The conclusion of the study was these countries were not ready for a monetary union.

Belke et.al. (2017) examined business cycle synchronization in the EMU with a special focus on the core-periphery pattern in the aftermath of the financial crisis. The study used seasonally adjusted real GDP as a proxy for business cycle because it's a comprehensive measure of economic activity with support from literature. Quarterly panel data for the period 1999 to 2015 was used and the study employed pairwise correlation analysis technique. It established that the synchronization of economic activity between the core and the periphery fell markedly in the period after the start of the financial crisis (2008Q1-2015Q4) compared to the pre-crisis period (1999Q1-2007Q4). This meant that the peripheral countries became less aligned relative to both the core countries and other economies outside of the EMU in the crisis period. Furthermore, the peripheral countries became also less aligned among themselves, in contrast to the cluster of core countries that did not show any change synchronization between the pre- and the crisis period. The study concluded that the financial crisis led to a desynchronization of the cycle as only the periphery was affected by high risk premium for its sovereign and the private sector.

Moreover, individual countries had cycles of different amplitudes, which imply that even countries which share a common currency might require a different monetary policy stance. De Grauwe and Ji (2017) carried out a study on International synchronization of business cycles. The study employed panel data for the period 1995 to 2014 for a group of Euro Zone countries and another group of industrialized countries outside Euro Zone. It employed a two-country behavioral macroeconomic model and used correlational analysis to study the synchronicity of business cycles. The business cycle component was obtained by using the Hodrick-Prescot (HP) filter on GDP data. The study established a high correlation not only among the Euro Zone countries but also among the industrial countries outside Euro Zone.

Tomić and Demanuele (2017) investigated the degree of business cycle synchronization between the new Euro areas and Croatia. The study utilized quarterly panel data for the period 1995 to 2014 and employed correlation analysis to test for the synchronization of business cycles. In this study, business cycles were extracted using the Hodrick-Prescott filter method. The study results showed that the business cycles between these countries were synchronized suggesting that Croatia satisfies this selection criteria for inclusion in the European monetary union.

Kaboro, Kalio and Kibet (2018) studied the effect of real GDP growth convergence on exchange rate volatility in EAC. Panel data for the period 2000 to 2016 was used in this study. The study employed a fixed effects model to analyze the relationship between GDP

growth convergence and exchange rate volatility. The empirical findings established a negative effect of GDP convergence on exchange rate volatility implying that convergence in GDP growth reduces exchange rate volatility in EAC. The conclusion of the study was that the EAC countries should harmonize their economies for an effective monetary union to be formed.

Githuku *et al*. (2018) undertook a study on income convergence in the East African Community. The study used panel data for the period 1990 to 2012 and employed the autoregressive distributed lag model technique of analysis. The study's findings established existence of conditional convergence and that the per capita GDP growth rate was positively affected by physical capital and exchange rate while it was inversely influenced by human capital and inflation. However, the study did not support unconditional convergence implying that the catching up process in EAC exists after controlling for differences in steady states. Thus, the income differences between EAC member countries were found to decline with time after controlling for differences in steady states.

Tapsoba *et al.* (2019) studied fiscal convergence in Africa by establishing the role of RECs in fiscal convergence in Africa. The variables of concern in this study were categorized into economic and institutional variables. The economic variables used in the study included public debt, GDP growth, inflation rate and current account balances while the institutional variables included political stability, level of democracy and rule of law. The

study used panel data from 1990 to 2015 and employed a GMM estimation technique. According to the study, African RECs significantly reduce fiscal divergence between countries. The conclusion of the study was that common monetary areas are more efficient in fostering fiscal convergence.

2.4 Overview of Literature

In this study, three main theories relevant to monetary union have been reviewed namely; the Optimum Currency Area theory, the neoclassical growth theory and the endogenous growth theory. The OCA theory is the main analytical framework used to analyze the readiness of countries seeking to form a monetary union. The theory provides factors that should be considered in the assessment of monetary union formation. Countries ready to enter into a monetary union should fulfill the following criteria: mobility in factors of production, flexibility of prices and wages, openness to trade, product diversification, degree of similarity of inflation rates, financial integration, effectiveness and credibility of monetary policy, high covariation in economic activities, synchronization of business cycles and political factors among other factors.

The neoclassical growth theory postulates that long-run growth is determined by technology, capital and labour. Through the assumptions of diminishing returns to factors of production and exogenous growth in technology, an economy converges to its steady-state growth equilibrium. Income convergence is thus explained by the high rate of return on capital in poor countries and as such, these countries eventually catch-up with richer

countries. The neoclassical growth theory is thus very important in explaining the convergence of economies. On the other hand, the endogenous growth theory believes that economic growth is primarily an endogenous process. Unlike the neoclassical model, this theory is able to account for the persistently positive growth that exists in most developed countries which is a result of technological development enhanced by policies.

Based on the foregoing, this study is anchored on the OCA theory and the neoclassical growth theory. The OCA theory has been established as the best framework for underpinning monetary union studies while the neoclassical supports the steady-state growth which explains income convergence. The OCA theory has been regarded as the only analytical framework that has been projected to support studies on monetary unification. The OCA theory is relevant in the current study for it identifies important factors to be considered for monetary unification. Similarity of inflation, trade openness, exchange rate volatility and business cycles are important variables that the current study will use to establish the state of macroeconomic convergence in EAC. The endogenous growth model does not support convergence since it assumes that increasing returns on factor inputs are due to technological progress and therefore, is not appropriate for the current study. This study therefore, adopts the neoclassical model since it explains the process of economic convergence between countries.

The empirical literature reviewed indicates that countries envisaging forming a monetary union should exhibit macroeconomic convergence for a monetary union to be successful.

Specifically, countries forming a monetary union require to have high wage and product flexibility, factor productivity, similar economic structure among other factors. The studies reviewed utilized mostly panel data for the analysis and employed a number of methods including structural VAR, correlation analysis, GMM and cointegration analysis.

Studies have been conducted on the proposed EAMU such as Mkenda (2011) on whether EAC constituted an OCA, Mafusire and Brixiova (2012) who investigated macroeconomic shock synchronization, Buigut (2011) who studied whether a fast-track EAMU would be beneficial and Githuku *et al.* (2018) who analyzed income convergence in the EAC countries. These studies looked at the convergence of inflation rates and GDP. However, this study deviates from them by undertaking a comprehensive analysis of convergence by considering all the variables both monetary and fiscal variables as outlined in the EAMU protocol. Together with these macroeconomic variables, the study further analyzes income convergence by augmenting important control variables such as the effectiveness of government to the standard model towards a single currency in EAC. The current study also analyzes business cycles synchronization in EAC since it is the most commonly used method in analyzing monetary unions (Sheikh *et al*., 2011). This analysis is done by employing the cointegration analysis unlike correlation analysis used by Githuku et al. (2018).

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the methodology used in the study. It provides the research design, theoretical framework for the study, specification of the empirical model, definition and measurement of variables, estimation technique, diagnostic tests, type and sources of data.

3.2 Research Design

This study adopted a non-experimental research design since it did not employ any controls on the data. The study used both time series and panel data from various publications including World Bank and IMF. The study also employed a log-linear dynamic panel data models estimated

using Generalized Method of Moments (GMM) as well as time series regression models estimated using least squares techniques to achieve the objectives of the study.

3.3 Theoretical Framework

The theoretical underpinning of this study is anchored in the OCA and the neo-classical growth theory. Based on these economic theories, sections 3.3.1 to 3.3.3 describe the relevant theoretical framework in accordance with the objectives of the study.

3.3.1 Convergence in the Neo-classical model

According to Solow-Swan (1956) neo-classical growth theory, the production function is

used to describe the long-run growth process and equilibrium of an economy. Considering the economy's output relationship with capital, labour and technology, the production function can be expressed as:

$$Y_t = f(K_t, A_t L_t) \quad \ldots\ldots 3.1$$

Where Y, A, K and L are output, the level of technology, the stock of physical capital and labour force at time t, respectively. Equation (3.1) may be expressed in terms of output per effective labour as:

$$y_t = f(k_t) \quad \ldots\ldots 3.2$$

Where $k_t = \frac{K_t}{A_t L_t}$ and $y_t = \frac{Y_t}{A_t L_t}$

This implies that the growth rate of output is dependent on the growth in labour, capital and technological progress. In the Solow (1956) model, the growth of labour is assumed to be at a constant rate (n). Physical capital growth occurs through investment expenditures (I). The theory assumes that all savings are invested and that savings are a constant proportion (s) of output and that capital depreciates at a rate (δ) so that the net increase in capital can be given as:

$$\dot{K}_t = sY_t - \delta K_t \quad \ldots\ldots 3.3$$

Where sY_t is the investments. Technological progress is considered exogenous with a constant and exogenously determined growth rate (g).

The steady-state equilibrium is analysed by deriving the expression for the evolution of capital per worker over time. Taking the assumptions of the model into account, the evolution of capital-labour ratio can be written as follows (see derivations in appendix A):

$$\dot{k}_t = sf(k_t) - (n + g + \partial)k_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.4$$

In the steady-state, equilibrium $\dot{k}_t = 0$ and incorporating this condition in equation (3.4) yields

$$sf(k_t) = (n + g + \partial)k_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.5$$

Equation (3.5) implies that growth disparities across regions occur not only due to differences in the growth of capital relative to labour, but also because of possible differences in technological progress. Persistent variations in rates of technological progress have the potential to hasten or reduce the extent in which regions converge to each other. Equation (3.5) can be expressed as:

$$sy_t = (n + g + \delta)k_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.6$$

From equation (3.6),

$$k_t = \frac{sy_t}{n + g + \delta} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.7$$

Assuming a Cobb-Douglas production function, equation (3.2) can be expressed as:

$$y_t = (k_t)^{\alpha} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.8$$

Substituting equation (3.7) into (3.8) yields:

$$y_t = [s/n + g + \delta]^{\alpha/1-\alpha} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.9$$

The convergence of an economy to its steady-state position is measured by the speed of the transitional dynamics, that is the speed of convergence. Some economies may be close to their steady-state while others may be far from the steady-state. In the literature, the speed of convergence is given by the log-linear approximation in the neighborhood of the steady-state (Barro & Sala-i- Martin, 1995). The convergence of y_t to it's steady-state value y^* is given as:

$$\frac{\partial \ln y_t}{\partial t} = -\gamma \ln(y_t - y^*) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.10$$

The equation (3.10) implies that:

$$\ln y_t = (1 - e^{-\gamma t})\ln y^* + e^{-\gamma t}\ln y_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.11$$

(See Njuguna , 1999), where γ is the speed of convergence .

3.3.2 Convergence of Monetary and Fiscal variables

The OCA theory posits that countries envisaging to form a monetary union should fulfill set criteria as a condition for convergence, towards a monetary union. The OCA theory has been identified as the main analytical framework used in analyzing macroeconomic convergence of countries with an intention of forming a monetary union (Mongelli, 2008). The theory is premised on the concept of sigma convergence which states that the dispersion of a variable across a group of economies tends to fall over time for convergence to be realized (Hammouda *et al*., 2009). Therefore, a group of countries exhibit convergence if the standard deviation (σ) is declining over time such that:

$$\sigma_{t+T} < \sigma_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.12$$

Where σ_t is the standard deviation of the monetary or fiscal variable concerned; t and T indicate time period.

3.3.3 Business Cycles Synchronization

Stochastic convergence is grounded on whether long-run forecasts of output differences tend to zero as the forecasting time tends to infinity (Bernard & Durlaf, 1995). A number of countries will converge if their long-term forecasts of output are equal at a fixed time t.

$$\lim_{k\to\infty} E\left(Y_{i,t+k} - Y_{j,t+k}|I_t\right) = 0 \qquad \forall j \neq i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.13$$

Where Y_i and Y_j are output for country i and j, respectively.

If the output differences between a group of countries are mean zero stationary process, then the above definition of convergence will hold (Hammouda *et al.,* 2009). So as for countries i and j to converge, their outputs must be cointegrated with cointegrating vector $(1 \quad -1)$. Additionally, if output series are trend stationary, the implication is that the time trends for each country must be the same. However, according to Hammouda *et al.* (2009), even though countries are not converging in the sense of the above definition, they may still respond to the same long-run driving proceses meaning they may face same permanent shocks with different long-run weights. Therefore a group of countries contain a single common trend if the long-term forecasts of output are proportional at a fixed time t.

$$\lim_{k\to\infty}\left(y_{i,t+k} - \alpha'_j \bar{y}_{t+k}\middle|I_t\right) = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.14$$

The implication is that countries i and j have a common trend if their output series are cointegrated with cointegrating vectors $(1 \quad -\alpha)$. According to Bernard and Durlaf (1995), this is useful if there exists a possibility that there are a small number of stochastic trends affecting output which differ in magnitude across countries. The analysis of convergence is studied by examing the time series properties of various output series. The test for common trends for this study employs Johansen multivariate cointegration techniques following Bernard and Durlaf (1995).

The pocess assumes a finite-vector autoregressivive representation expressed as;

$$\Delta Y_t = \eta(L)\Delta Y_t + \prod Y_{t-1} + \mu + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.15$$

Where $\eta_i = -[A_{i+1} + \cdots - A_k] \;\; i = 1, \ldots, k-1$

And $\prod = -[I - A_1] - \cdots - A_k$

$\prod$ represents the long-run relationship of the individual output series while $\eta(L)$ traces out the short-run impact of shocks to the system. The interest is the long-run relationships and thus all the tests and estimates of cointegrating vectors come from the matrix $\prod$ which can be written as:

$$\Delta Y_t = \prod_0 + \prod_1 Y_{t-1} + \cdots + \prod_p Y_{t-p} + \mu + \varepsilon_t \ldots\ldots\ldots\ldots\ldots 3.16$$

Where Y_t and $\prod$ are output and matrix of coefficients respectively while ε_t is the error term.

The interest in equation (3.16) is the rank of $\prod$ since it relates to the number of cointegrating vectors. Given $p \times r$ matrix of rank $r \leq p$, if the rank of $\prod$ equals p, then Y_t is a stationary process. If the rank of $\prod$ is $0 \leq r \leq p$,then there are r cointegrating vectors for the individual series in Y_t meaning the group of countries are driven by $p - r$ common shocks. If the rank of $\prod$ is equal to zero, there are p stochastic trends and the long-run output levels are not related across countries. Thus for convergence of individual outputs for a group of countries, there must be $p - 1$ cointegrating vectors of the form $(1 \quad -1)$ or one common long-run trend.

3.4 The Empirical Models

3.4.1 Income convergence

To achieve the first objective of the study, equations (3.10) and (3.11) were used. To investigate absolute convergence, following Barro and Sala-i-martin (1995) and Hammouda *et al.*(2009) the model is specified as;

$$\ln(y_{it}) = \mu + (1 - \beta)\ln(y_{i,t-1}) + \varepsilon_{i,t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 3.17$$

Equation (3.17) can be expressed as;

$$\ln y_{i,t} = \mu + \varphi \ln y_{i,t-1} + \varepsilon_{i,t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 3.18$$

where $\varphi = 1 - \beta$, y_{it} is the country i's real GDP in time period t. μ and φ are parameters to be estimated with $0 < \varphi < 1$ and $\varepsilon_{i,t}$ is a disturbance term. Absolute convergence would be supported if $\varphi > 0$ since the annual growth rate ($\log(y_{i,t}/y_{i,t-1})$ is inversely related to $\log(y_{i,t-1})$. However, Mankiw *et al*., (1992) argued that economies have different steady-state positions due to differences in levels of technology, savings or population growth rates. To take into consideration of the differences, an augmented growth model is used to analyze the conditional convergence. The conditional convergence model is derived by augmenting equation (3.18) with control variables to take the following form:

$$\ln y_{i,t} = \varphi \ln y_{i,t-1} + x'_{i,t}\theta + n_i + \mu_{i,t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 3.19$$

Where $x'_{i,t}$ is a vector of control variables. Following Islam (1995) and considering the peculiarities of the EAC economies, the control variables used are, gross capital formation, human capital, trade openness, governance effectiveness, FDI, gross government debt, Official Development Assistance (ODA), government consumption expenditure, population growth and exchange rate.

From the estimate of convergence coefficient (φ), two indicators often used to characterize convergence can be calculated. The speed of convergence and the half-life. The speed of convergence measures the speed at which economies converge towards the steady state and the half-life is the time necessary for the economies to cover half of the initial lag from their steady states. Following Islam (1995), the speed of convergence is calculated as follows:

$$\lambda = -\frac{\log(\varphi)}{T} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots .. (3.20)$$

Where (λ) is the speed of convergence and T is the total time of the study period. On the other hand, the half-life is defined as the time necessary for the economies to cover half of the initial lag from their steady states and is calculated as follows:

$$\tau = \frac{\ln(2)}{\lambda} X\ 100 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots . (3.21)$$

Where (τ) is the half-life.

3.4.2 Monetary Variables and Fiscal Variable Convergence

In order to assess state of convergence in monetary variables and fiscal variable, equation (3.12) was used with modifications to suit the study. This equation is the sigma convergence version that states that the dispersion of monetary variables and fiscal variable across a group of countries tends to fall over time. To estimate the equation, the variability of the monetary variables and fiscal variable, the study follows Bayoumi and Eichengreen, (1998). The basic equation for the variability can be expressed as:

$$\sigma_{zi,t} = \omega + \alpha t + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots .3.22$$

Where σ is the standard deviation, $z_{i,t}$ are the monetary variables and fiscal variable where i=1,2,3 for exchange rate, inflation rate and fiscal variable, respectively. ω and α are parameter estimates. The variability of the monetary variables and fiscal variable is affected by other factors which include; asymmetry of business cycles, trade structures, bilateral trade and relative size of the countries (Bayoumi & Eichengreen, 1998). Thus, following Tapsoba *et al*., (2019), equation (3.22) was modified and expanded to analyze the differences in the monetary and fiscal variables. The expanded function to be estimated takes the following form:

$$\phi_{zi,t} = \omega + \alpha t + x'\theta_{i,t} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.23$$

Where ϕ are deviations in the monetary and fiscal variables while x' are control variables which includes asymmetry of business cycles, trade structures, bilateral trade, government effectiveness relative size of the respective countries, output gap, bank credit to private sector, broad money supply, interest rate, price level, debt, current account and political instability. For convergence, ϕ should decline with time meaning α should be negative and less than one.

3.4.3 Business Cycles Synchronization

To achieve the fourth objective, equation (3.16) was used. The study employed the Johansen multivariate test of cointegration procedure to test for convergence in business cycles or output gaps. The real GDP can be decomposed into four latent components which include secular trend (Tt), cyclical component (Ct), seasonal component (St) and irregular component (It) (Dagum & Bianconcini, 2016). According to Dagum and Bianconcini

(2016), the cyclical component is superimposed upon the secular component and this is what constitutes the business cycle. Therefore, the real GDP in the four EAC countries was decomposed into the four components such that:

$$Y_t = (T_t C_t) + S_t + I_t \quad \ldots\ldots 3.24$$

Where Y_t, $T_t C_t$, S_t and I_t are real GDP, business cycle, seasonal component and irregular component respectively. The business cycle is thus expressed as;

$$(T_t C_t) = Y_t - (S_t + I_t) \quad \ldots\ldots 3.25$$

The business cycles appear to reach their peaks during periods of economic prosperity and their troughs during periods of depression. The business cycles were extracted using the R-studio statistical programme. Once the business cycles were extracted, the Johansen multivariate procedure was employed to analyze the synchronization of business cycles.

In this study, the country taken as a numeraire to estimate the suitability of a monetary union is Kenya, because it is widely perceived as the core member of the EAC area to which other potential participants need to converge.

3.5 Definition and Measurement of Variables

Table 3.1 gives the definition of the variables used in the study

Table 3. 1: Definition and Measurement of variables

Variable	Definition	Measurement
GDP growth (Y_t)	This is the percentage change in a country's GDP in a given year	Percentage change in GDP of country (i) in a given year
Capital formation (K_t)	A proxy for investments and includes assets such as land, machinery, buildings etc. (Gross Capital formation as a percentage of GDP was used as a proxy)	The value in US dollars of land improvements, plant, machinery, and equipment purchases; and the construction of roads, railways, schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings expressed as a percentage of GDP
Human Capital (h_t)	Level of educational achievement	Average number of schooling years
Bilateral trade	The bilateral exports to domestic GDP between two countries	$trade_{ij,t} = \frac{1}{T}\sum_{t=1}^{T}\left[\frac{X_{ij,t}}{y_{i,t}} + \frac{X_{ji,t}}{y_{j,t}}\right]$ Where $X_{ij,t}$ are exports from Kenya to other EAC countries in time t expressed as a percentage of GDP

Variable	Definition	Measurement
		while $X_{ji,t}$ are exports from other EAC countries to Kenya expressed as a percentage of GDP
Trade Structure (TS)	A measure of the dissimilarity in export commodity structures in the EAC countries as measured by the sum of the absolute differences in the shares of agricultural (A) and manufacturing (M) trade in total merchandise trade	$TS = \left\|A_{it} - A_{jt}\right\| + \left\|M_{it} - M_{jt}\right\|$ Where $A_{it}\ and\ A_{jt}$ are Shares of Agricultural exports between Kenya and other EAC countries respectively while $M_{it}\ and\ M_{jt}$ are shares of Manufatured exports between Kenya and other EAC countries respectively
Standard deviation of Real exchange rate changes	A measure of volatility of bilateral exchange rate between countries	$\sigma = \sqrt{\frac{\sum(e_i - e^*)^2}{N}}$ where σ is the standard deviation of exchange rate, e_i and e^* are the respective country's exchange rate and mean exchange rate respectively while N is the number of observations.

Variable	Definition	Measurement
Inflation rate	The persistent increase in prices of goods and services over a specified period of time.	The annual percentage change in the cost of average consumer goods and services in a given country
Output gap	The tendency of output gap to conform to a similar pattern	The difference between the value in US$ of potential and actual output
Economic size	Mean of the logarithm of the two GDPs measured in U.S. dollars. It measures the size of the economy and assess utility from maintaining own currency.	$Size_{ij,t} = 1/T\sum(\log y_{it} + \log y_{jt})$ where y is GDP in $ while i and j are Kenya and other EAC member states respectively.
Government effectiveness	Perception on quality of public services, the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	An index obtained from world governance indicators that ranges between -2.5 to 2.5.

Variable	Definition	Measurement
Trade Openness	It measures the extent to which a country is open to trade	The sum of exports and imports of goods and services measured as a share of GDP.
Political instability	measures perceptions by the citizens of the likelihood of political instability and/or politically-motivated violence, including terrorism.	An index obtained from world governance indicators that ranges between -2.5 to 2.5
Gross government debt	A measure of governments total liability in a specific year.	Total government debt including domestic and foreign liabilities such as currency and money deposits, securities other than shares, and loans expressed as a percentage of GDP.
Foreign Direct Investments	Personal remittances comprising personal transfers and compensation of employees in a particular year.	Amount of remittances received expressed as a percentage of GDP.
Official Development Assessment	Net official development assistance received in a country in a given year.	All Development assistance funds received expressed as percentage of GDP.

Variable	Definition	Measurement
Government consumption expenditure	General government final consumption expenditure including all government current expenditures for purchases of goods and services in a country in a given year.	Total government expenditure expressed as a percentage of GDP.
Population growth rate	The average annual rate of change of population of a given country in a particular year	The exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage.
Exchange rate	Exchange rate is the value of EAC's member countries currency in terms of the US dollar.	It is calculated as an annual average value of the respective EAC's member country's currency relative to the U.S. dollar.
Business Cycles Asymmetry	The variable measures the similarity of cyclical component of output between two countries.	The difference in the logarithm of real output between country *i* and country *j*.
Bank credit to private sector	A measure of accessibility of financial resources by the	All financial resources provided to the private sector by financial

Variable	Definition	Measurement
	private sector in a country.	corporations in a particular year expressed as a percentage of GDP.
Broad money supply	It is the sum of currency outside banks; demand deposits other than those of the central government; savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler's cheques; and other securities such as certificates of deposit and commercial paper.	The sum of currency outside banks expressed as a percentage of GDP.
Price level	Measures the changes in cost of purchasing the same basket of goods and services in EAC countries in a particular period.	The Consumer Price Index was used as measured by Laspeyres-price-index $P_{i,t} = \frac{\sum(P_{i,t})\times(Q_{i,0})}{\sum(P_{i,0})\times(Q_{i,0})} \times 100$ Where $P_{i,t}$ is average price of individual item in country i, in time t,

Variable	Definition	Measurement
		$P_{i,0}$ is average price of individual item in country i, in base period, $Q_{i,0}$ is average quantity items in country i, in base period
Current Account	It is a measure of a country's trade balance including net income and direct payments.	The sum in US$ of net exports of goods and services, net primary income, and net secondary income.
Exchange rate deviations	Measures the differences in exchange rates between EAC countries with Kenya as the reference country	$e_{ij,t} = e_{it} - e_{jt}$where $e_{ij,t}$ is the exchange rate deviation from country i in time t, $e_{it}$is exchange rate for country i in time t where i=1,2,3,4 for Burundi, Rwanda, Tanzania and Uganda while e_{jt} is exchange rate for Kenya in time t
Inflation rate deviations	Measures the differences in inflation rates between EAC countries with Kenya as the reference country	$Inf_{ij,t} = Inf_{it} - Inf_{jt}$where $Inf_{ij,t}$ is the inflation rate deviation from country i in time t, Inf_{it} is inflation rate for country i in time t where i=1,2,3,4 for Burundi, Rwanda,

Variable	Definition	Measurement
		Tanzania and Uganda while Inf_{jt} is inflation rate for Kenya in time t
Fiscal variable deviations	Measures the differences in fiscal deficit between EAC countries with Kenya as the reference country	$FD_{ij,t} = FD_{it} - FD_{jt}$ where $FD_{ij,t}$ is the fiscal deficit deviation from country i in time t, FD_{it} is fiscal deficit for country i in time t measured as a percentage of GDP where i=1,2,3,4 for Burundi, Rwanda, Tanzania and Uganda while FD_{jt} is fiscal deficit for Kenya in time t
Debt Divergent	Measures the differences in public debt between EAC countries with Kenya as the reference country	$Dt_{ij,t} = Dt_{it} - Dt_{jt}$ where $Dt_{ij,t}$ is the debt deviation from country i in time t, $D_{it}$is debt for country i in time t where i=1,2,3,4 for Burundi, Rwanda, Tanzania and Uganda while D_{jt} is debt for Kenya in time t.
GDP Divergent	Measures the differences in GDP between EAC countries with Kenya as the reference	$GDP_{ij,t} = GDP_{it} - GDP_{jt}$ where $GDP_{ij,t}$ is the GDP deviation from country i in time t, GDP_{it} is GDP for

Variable	Definition	Measurement
	country	country i in time t where i=1,2,3,4 for Burundi, Rwanda, Tanzania and Uganda while GPD_{jt} is GDP for Kenya in time t
Current Account Divergence	Measures the differences in current account between EAC countries with Kenya as the reference country	$CA_{ij,t} = CA_{it} - CA_{jt}$ where $CA_{ij,t}$ is the current account deviation from country i in time t, $CA_{it}$is debt for country i in time t where i=1,2,3,4 for Burundi, Rwanda, Tanzania and Uganda while CA_{jt} is debt for Kenya in time t
Government Effectiveness Divergence	Measures the differences in government effectiveness between EAC countries with Kenya as the reference country	$GE_{ij,t} = GE_{it} - GE_{jt}$ where $GE_{ij,t}$ is the Government deviation from country i in time t, GE_{it} is government effectiveness for country i in time t where i=1,2,3,4 for Burundi, Rwanda, Tanzania and Uganda while GE_{jt} is government effectiveness for Kenya in time t.

Variable	Definition	Measurement
Political instability divergence	Measures the differences in political stability between EAC countries with Kenya as the reference country	$PS_{ij,t} = PS_{it} - PS_{jt}$ where $PS_{ij,t}$ is the political stability deviation from country i in time t, PS_{it} is political stability for country i in time t where i=1,2,3,4 for Burundi, Rwanda, Tanzania and Uganda while PS_{jt} is political stability for Kenya in time t
Real interest rate	The lending interest rate adjusted for inflation	The annual bank rate divided by CPI expressed as a percentage

3.6 Data Type and Source

This study made use of secondary, time series and panel data for analysis. The data consists of yearly observations of the variables in first, second and third objectives and quarterly for the variables in the fourth objective. The data was obtained from the Economic Surveys, IMF´s International Financial Statistics (IFS), IMF Direction of Trade Statistics and World Bank databases.

3.7 Data Analysis

To achieve the first objective, equation (3.18) and (3,19) were estimated using Generalized Method of Moments (GMM) technique due to the presence of lagged dependent variable as an explanatory variable as suggested by Arellano and Bond (1991). To achieve

objectives two and three, equations (3.22) and (3.23) were modified to suite the variables of concern and were estimated using time series and panel data estimation techniques. For the fourth objective, the study made use of equation (3.25) and the Johnsen cointegration analysis was utilized to achieve the objective.

3.8 Diagnostic Tests

The study undertakes two diagnostic tests: diagnostic tests on data and model. The stationarity test was conducted on data to detect presence of unit root in the series to avoid spurious regression. Each series was tested for the presence of unit root using Im-Pesaran-Shin (IPS) and Levin-Lin Chu (LLC) unit root tests for the panel data models. For the models where time series data models were employed, Augmented Dickey-fuller and Clemente-Maontanes-Reyes (CMR) (1998) unit root tests were used. The CMR test was preferred since it allows for the possibility of having structural breaks in the mean of the series. The advantage of testing for unit root test and at the same time allowing for structural breaks prevents the tests results from being biased towards non-stationarity.

The model diagnostic tests were also carried out on the models used in the study. For the first objective, the study employed Sargan (1985) test of over-identifying restrictions as suggested by Arellano and Bond (1991). The null hypothesis of this test is the overidentifying restrictions are valid against the alternative that they are not valid. Therefore, this is a test of overall validity of the instruments used. The study also employed the Arellano-Bond test for zero autocorrelation in first differenced errors to test for

autocorrelation in equation (3.18) and (3.19). This test calculates the first and second-order autocorrelation in the first-differenced errors. If the errors are serially independent, those in first-differences will exhibit first but not second-order serial correlation (Arellano, 2003). Because the first difference of independently and identically distributed idiosyncratic errors will be serially correlated, rejecting the null hypothesis of no serial correlation in the first-differenced errors at order one does not imply that the model is mis-specified. Rejecting the null hypothesis at higher orders implies that the moment conditions are not valid (Blundell, Bond & Windmeijer, 2000).

The Hausman test was carried out in order to ascertain the appropriate model for equation (3.23). The Hausman test investigates the null hypothesis that the random effects model is the most appropriate model against the alternative that the fixed effects model is the most appropriate. The rejection of the null hypothesis implies the fixed effects model is more appropriate while failure to reject the null hypothesis implies that the random effects model is more appropriate for the study.

CHAPTER FOUR

EMPIRICAL FINDINGS

4.1 Introduction

This chapter presents the empirical findings of the study. The chapter is organized in such a way that section 4.2 presents the descriptive statistics, section 4.3 presents the results of diagnostic tests carried out while section 4.4 presents the empirical results for each of the models used to achieve the study objectives.

4.2 Descriptive Statistics

Table 4.1 provides summary of the descriptive statistics of the variables used in the study based on data from Burundi, Kenya, Rwanda, Tanzania and Uganda for the period 2000 to 2018. The summary statistics considered include the mean, standard deviation, maximum and minimum values.

Table 4. 1: Descriptive statistics of variables used in the study

Variable	Observations	Mean	Std. Dev.	Min	Max
GDP Growth (%)	95	5.53	2.79	-3.9	13.19
Gross Capital formation (%)	95	21.12	7.42	2.78	37.65
Human Capital (Mean years of schooling)	95	4.39	1.39	1.8	6.5
Trade Openness (%)	95	42.66	9.56	20.96	64.48
Government Effectiveness (Index)	95	-0.57	0.4	-1.42	0.26
Inflation Rate (%)	95	7.80	5.19	-2.81	26.24
Gross Government Debt (%)	95	54.38	34.99	19.19	172.74
Foreign Direct Investments (%)	95	2.21	1.78	-0.0013	6.48
Official Development Assistance (US$)	95	0.13	0.09	0.03	0.39
Remittances (%)	95	1.87	1.59	0.0009	7.15
Government Consumption Expenditure (%)	95	14.63	4.38	7.5	26.21
Population Growth Rate (%)	95	2.89	0.5	1.43	5.6
Gross Savings (%)	95	14.69	7.44	-1.5	30.54
GDP (Current prices, US$ Billion)	95	19.14	19.78	0.78	87.91
Fiscal Deficit (%)	95	-2.73	1.92	-8.38	0.93
Bank Credit to Private Sector (%)	95	16.28	7.20	3.11	34.19
Broad Money Supply (%)	95	24.55	7.90	13.05	43.25
Price Level	95	100	43.49	38.09	188.68
Exchange Rate	95	0.0032	0.0046	0.0003	0.0149
Interest Rate (%)	95	8.61	7.18	-16.67	22.996
Political Instability (Index)	95	-0.95	0.617	-2.5	0.23

Source: Author's computation from collected data.

The summary presented in Table 4.1 shows that the average GDP growth rate for the EAC countries was 5.53 per cent per annum with a standard deviation of 2.79 per cent. The rate of GDP growth ranged between -3.9 and 13.2 per cent. The minimum growth rate of -3.9 per cent was observed in Burundi in 2015 while the maximum growth rate of 13.2 per cent

was observed in Rwanda in 2002. The average rate of growth in GDP achieved in EAC was below the EAC convergence target of 7 per cent. The convergence criteria required all EAC economies to have attained a minimum growth rate of 7 per cent in 2007 that should be sustained before convergence takes place. The standard deviation of 2.79 per cent reflects a relatively high level of dispersion of the rate of growth in GDP in EAC. Convergence is expected to take place if the variability in growth declined with time. Barell *et al*. (2008) argues that, high variations in growth reflects differences in the level of skills, knowledge and capital endowments which may make the catching up process to take longer than expected.

Gross capital formation as a percentage of GDP averaged 21.12 per cent with a deviation of 7.42 per cent. Capital formation was low in Burundi in the year 2000 and high in Tanzania in 2014 at 2.78 per cent and 37.65 per cent, respectively. According to the neoclassical growth theory, removal of barriers through regional economic integration would produce capital flows to catching up economies with lower capital-output ratios and higher marginal product of capital, thus boosting investment and growth (Franks et al., 2018). This does not appear to be the case for EAC countries in that the variation in gross capital formation from the mean was high at 7.42 implying that the catch-up process might take longer.

Human capital, which is a measure of educational attainment averaged 4.39 years among the EAC member states between 2000 and 2018. The lowest level of educational attainment

was 1.8 years and a maximum of 6.5 years with a standard deviation of 1.39 years. Burundi was observed to have the lowest levels of educational attainment with the minimum of 1.8 years recorded in 2000 while Kenya had the highest levels of educational attainment of 6.5 years recorded in 2005. The range of 4.7 years in human capital across the countries signifies dissimilarity in human capital formation. The levels and disparities in educational attainment across the EAC countries signify low levels of investment in human capital, which impacts negatively on growth of productivity and movement of the countries towards a monetary union.

The trade openness index for the EAC countries averaged 42.66 per cent between 2000 and 2018 with a standard deviation of 9.59 per cent. Trade openness ranged between 20.96 per cent observed in Burundi in 2001 and 64.48 per cent observed in Kenya in 2005. The higher the index, the higher the influence of trade on domestic activities and the stronger the county's economy. The more the region is open to trade, the smaller the output effects of a given change in the money supply meaning decline in the cost of a monetary union and thus increasing the benefits from a monetary union (Karras, 2001). Trade openness intensifies competition, thus creating scope for increasing productivity and innovation. Firms also enjoy economies of scale due to large markets as a result of trade openness. Though EAC countries participate in international trade, the mean trade index is relatively low, and this reduces the competitiveness of these countries and hence, limiting their scope for increasing productivity and innovation, and benefits from economies of scale.

Government effectiveness index averaged -0.57 with a standard deviation of 0.4. The minimum and maximum index over the study period was -1.42 and 0.26, respectively. The index measures the perception by citizens on quality of public services, the degree of independence of public service from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. The index ranges between negative 2.5 (weak) and positive 2.5 (strong) (World Bank, 2016). Based on the statistics, EAC member countries on average suffer from weak government effectiveness. A mean of -0.57 implies that the citizens perceive the government's ability to effectively formulate and implement appropriate policies to be weak. A positive perception by the citizens on the ability of governments to formulate and implement good policies is critical in moving towards a monetary union.

The average inflation rate observed was 7.8 per cent with a standard deviation of 5.19 per cent, implying high variability of inflation rate within the EAC. The minimum inflation rate of -2.8 per cent was observed in Burundi in 2018 while the highest inflation of 26.2 per cent was recorded in Kenya in 2008. The standard deviation shows that the variable exhibited high volatility contrary to the expectation of convergence criteria that requires less variations in inflation rate. The macroeconomic convergence criteria adopted by EAC countries required the inflation rate to be less than five per cent implying that EAC countries are yet to achieve the set inflation rate target.

The EAC countries attracted FDI that averaged 2.21 per cent of GDP between 2000 and

2018. The FDI fell between the range of -0.0013 per cent and 6.48 per cent of GDP where the lowest was observed in Burundi in 2001 and the highest in Uganda in 2006. The EU recorded FDI that ranged between 0.26 and 2.4 per cent of GDP between 1980 and 1998 before they entered into a monetary union. This means that the level of variability of FDI in EU was smaller than EAC during the period preceding monetary unification. The FDI is a primary source of technological transfer and a potential source of economic growth (Anyanwu, 2014). A monetary union in EAC would thus attract FDI to the less developed member countries, bringing the technology required for growth and development in these countries and ultimately aiding the catching up process (Wagner, 2001).

The ODA received in EAC between 2000 and 2018 was on average 0.12 per cent of GDP with a standard deviation of 0.09 per cent. The variable measures the foreign aid received by EAC countries from multilateral institutions to promote economic development. Burundi received the highest amount of ODA in 2004 which translated to 0.4 per cent of her GDP while Kenya received the lowest ODA of 0.03 per cent of the country's GDP in 2002. Between 1975 and 2005, WAEMU attracted a higher ODA than EAC when it was pursuing formation of a monetary union. On average, WAEMU received ODA 11.51 per cent of GDP with a standard deviation of 5.35 per cent. Countries that attract low ODA would be good for monetary unification since it reflects the capacity of these countries to drive growth related initiatives with domestically owned resources. However, ODA can affect growth positively if supplemented with stable macroeconomic policy environment (Girma, 2015). The EAC member countries are not able to meet all their financial needs

with domestically generated revenue and therefore, attracting more ODA would be beneficial to these country's growth agenda.

The remittances as a proportion of GDP in EAC averaged 1.87 per cent during the study period with a standard deviation of 1.6 per cent and a range of 7.15 per cent. The average remittance of 1.87 per cent of the GDP recorded by EAC countries is lower than the mean remittance of 6.22 per cent of GDP achieved by the SADC countries between 1994 and 2008. Regional integration is expected to attract higher capital flows to developing countries due to higher marginal productivity of capital in developing countries. Thus, if EAC countries have well-functioning domestic financial institutions, they stand a better chance of unlocking the potential for remittances to contribute to faster economic growth thus aiding convergence (Singh *et al*., 2011).

Government consumption expenditure as a proportion of GDP averaged 14.63 per cent with a standard deviation of 4.38 per cent. The lowest level of government consumption expenditure was 7.5 per cent observed in Uganda in 2016 while the maximum was 26.2 per cent of GDP observed in Burundi in 2018. Government expenditure as a proportion of GDP in EAC was low relative to WAEMU and SADC regions between 1985 and 2013. In WAEMU region, government consumption expenditure ranged between 12 and 25 per cent of GDP while it ranged between 10.9 and 39.8 per cent in SADC in the same period. Government consumption expenditure can influence economic growth positively thus enhancing convergence (Wahab, 2011). The level of government consumption in EAC can

thus, be utilized to promote economic growth and hence convergence.

The population growth rate averaged 2.89 per cent between 2000 and 2018 with a standard deviation of 0.5 per cent. Rwanda had the highest and lowest population growth rates at 5.6 and 1.43 per cent in 2000 and 2004, respectively. The average population growth rate in EAC was higher than the 2 per cent in SADC between 2006 and 2015 (Matchaya *et al*., 2018). According to Matchava *et. al*. (2018), high population growth rate shifts the age structure of the population towards the very young and in so doing increases the dependency ratio in families. The relatively high population growth rate in EAC is likely to negatively influence economic growth thus constrain the convergence process.

The gross savings as a proportion of GDP averaged 14.69 per cent with a standard deviation of 7.44 per cent in EAC during the period 2000 and 2018. Burundi reported the minimum gross savings ratio of -1.5 per cent of the GDP in 2008 while Tanzania had the highest gross savings ratio of 30.5 per cent of the GDP in Tanzania in 2017. The convergence criteria required the EAC countries to maintain a national savings to GDP ratio of greater than 20 per cent from 2007 - 2015 when the monetary union was to be introduced.

From Table 4.1, the average GDP measured at current prices, was 19.14 Billion US dollars with a standard deviation of 19.78 Billion US dollars. The GDP variable is used as an indicator of the size of the economy in this study. Economic size is important in exchange rate convergence in that it measures benefits of a stable currency that accrue to economies

in a monetary union (McKinnon, 1963). The higher the economic size of EAC member countries, the more the benefits of entering into a monetary union. The high variability of GDP in EAC member states is an indication of divergence in economic size. As observed by Kaboro *et al.* (2018), convergence in economic size reduces the volatility of exchange rate which is beneficial to the economies and this is not the case for EAC countries.

Fiscal deficit as a percentage of GDP in the EAC member countries during the study period averaged 2.73 per cent with a standard deviation of 1.92 per cent. Kenya reported the highest deficit of 8.38 per cent of GDP in 2015 while Rwanda had a fiscal surplus of 0.93 per cent of GDP in 2008. However, the average fiscal deficit of 2.73 per cent of GDP recorded by the EAC countries in 2000 – 2018 was close to the convergence criteria target of less than two per cent. The Maastricht criteria had set a target of less than three per cent for EMU countries. The EMU countries achieved the target by 1988 before entering into a monetary union (Arestis *et al.*, 2002). The implication is that EAC countries are unable to mobilize adequate revenues on their own and, therefore, have to rely on foreign grants, aid and borrowing to finance their budgets. High dependence on grants or aid for economic development is risky for those economies with a mission of forming a monetary union (Geda & Kebret, 2008).

Bank credit to private sector averaged 16.28 per cent of GDP between 2000 and 2018 in EAC with a standard deviation of 7.2 per cent. The expectation is that bank credit to private sector would reduce inflationary pressure and thus aid inflation convergence. The reported

level of variation in bank credit to private sector by EAC countries is relatively high and may pose a challenge achieving convergence within the expected time frame.

Broad money supply as a ratio of GDP averaged 24.55 per cent with a standard deviation of 7.9 per cent. The minimum and maximum broad money supply was 13.05 per cent and 43.25 per cent of the GDP observed in Uganda in 2000 and in Kenya in 2015, respectively. Broad money supply affects inflation through aggregate demand and its effect on money wages. As such, broad money supply has an effect on macroeconomic stability and therefore, influences convergence towards a monetary union. The high volatility of broad money supply in the EAC means that the countries are not getting closer to each other on money supply and, therefore, a uniform monetary policy may not achieve optimal results in the region.

Price level in EAC as measured by the consumer price index averaged 100 with a standard deviation of 43.49. This indicates that variations in the changes in the price level in EAC were quite high. The minimum and maximum price level was observed in Kenya in 2000 and Burundi in the year 2017 respectively. The high volatility of prices may be an indication of different countries adopting different monetary polices in addressing macroeconomic stability.

The exchange rate of EAC currency in reference to the US dollar averaged 0.0032 with a standard deviation of 0.0046. The minimum and maximum value of EAC currency to the

dollar was 0.00027 and 0.0149 respectively. The exchange rate variations in EAC countries is relatively low signifying stability in exchange rate in the EAC member states. The highest value of the dollar was observed in Kenya in 2007 while the lowest value was recorded in Uganda in 2017. The EU countries experienced low exchange rate variations in the period before formation of EMU. This favoured the convergence of the economies to a monetary union (Tenreyro, 2007).

The interest rate measured by the lending rate adjusted for inflation averaged 8.61 per cent among EAC member countries in the study period with a standard deviation of 7.18 per cent. Burundi suffered a low real interest rate 16.67 per cent in 2000 implying that the inflation rate was higher that the nominal interest rate while Rwanda had the highest interest rate of 22.996 per cent was recorded in Uganda in 2002. High interest rates are not attractive for investments and therefore no good for monetary union. The standard deviation of interest rate in EAC is high and this may lead to lack of convergence in inflation rate if EAC adopted a common monetary policy ((Busetti, Forni, Harvey, & Venditti, 2007).

Political Instability index averaged -0.95 with a standard deviation of 0.617. The minimum and maximum index was -2.5 and 0.23 observed in Burundi in 2004 and 2018 respectively. The index measures perceptions by citizens of EAC countries on the likelihood of political instability and/or politically-motivated violence, including terrorism. The index ranges between negative 2.5 which indicates a perception of high probability and positive 2.5 and

indicator of low probability (World Bank, 2016). Based on the statistics, EAC member countries have an average probability of suffering political instability since the average index is almost in the middle of the range. A mean of -0.95 implies that the citizens perceive the EAC countries are somehow likely to experience political instability. Political stability is important in providing a conducive environment for a monetary union in EAC.

4.3 Diagnostic Tests

Before model estimations, various diagnostic tests were carried out on the variables used in the study. They included stationarity test, pairwise correlation and variance inflation factor (VIF) to investigate potential multicollinearity. Model diagnostics were also conducted accordingly as discussed in section 3.6 from the previous chapter. The results are discussed in the next sub-sections.

4.3.1 Stationarity Test

The variables used in the first objective were tested for stationarity using Levin-Lin Chu (LLC) and Im-Pesaran-Shin (IPS) panel unit root tests and the results are presented Table A1. The unit root test was for the pooled data since the regression undertaken was for the panel and not individual series. Both LLC and IPS test the null hypothesis of presence of a unit root (non-stationary) against the alternative of no unit root (stationary). The rejection of the null hypothesis implies that the variable is stationary at levels thus, integrated of order zero I(0). Failure to reject the null hypothesis implies that the variable is non stationary at levels and would be integrated of order one I(1) if the first difference is

stationary. The decision was made such that a variable is stationary whenever either of the two tests reject the null hypothesis of unit root. Where both tests failed to reject the null hypothesis, the variable was differenced and again tested for stationarity before it was used in the regression analysis.

The unit root test results showed that all the variables except trade openness, ODA, government consumption expenditure, business cycles asymmetry and bank credit to private sector were found to be stationary at levels using the LLC or IPS panel unit root tests. This is because the p-values associated with the t-statistic were less than all conventional levels of statistical significance, therefore, rejecting the null hypothesis of unit root. All the variables that were found to be non-stationary became stationary after first difference meaning they were integrated of the first order.

According to Philips and Xiao (1998), a series that is not stationary implies that the variance of series is time dependent and does not return to a long-run deterministic path. The implication is that regression analysis with non-stationary series leads to spurious results meaning either rejection of a true relationship or acceptance of a false relationship (Ventosa-Santaulària, 2009). Therefore, to guarantee non-spurious results, all the variables that were found to be non-stationary were all differenced before model estimation.

The study also employed Clemente-Montanes-Reyes (1998) unit root test to test the stationarity of the variables in the second and third objectives. The test was preferred

because of its ability to allow for testing of stationarity on variables with structural breaks (Clemente *et al.*, 1998). The results are presented in section 4.4.2.

4.3.2 Multicollinearity Test

Multicollinearity occurs when independent variables in a regression model are highly correlated. High multicollinearity undermines the statistical significance of an independent variable therefore, affecting the reliability of the regression results (Gujarati, 2009). Therefore, detecting multicollinearity is important so as to control for the effect of reduced statistical significance of the independent variables. The study employed correlation analysis and variance inflation factor (VIF) as tests of multicollinearity. The pairwise correlation matrix was used to determine the degree of correlation among the independent variables that were used in the study and the results are summarized in Table A2. The variance inflation factor (VIF) was also used to measure the amount of multicollinearity in a set of multiple regression variables and the results are provided in Table A11.

From Table A2, the correlations between all the explanatory variables except gross savings and gross capital formation as well as gross savings and government consumption expenditure exhibited low correlation since the correlation coefficients were less than 0.8. According to Gujarati (2009), a correlation coefficient that is more than 0.8 is considered high correlation. The correlation coefficient between gross savings and Gross capital formation was 0.84. On the other hand, the correlation coefficient between gross savings and government consumption expenditure was 0.8 and therefore, the correlation between

these pair of variables was considered high. To rule out the problem of multicollinearity in the analysis, gross savings was dropped from the analysis.

The commonly given rule of the thumb, is that a VIF value that exceeds 10 indicates high multicollinearity (O'brien, 2007). As shown in Table A11, the mean VIF value was 4.0 and the values for each of the variable used in the regression were less than 10 thus, indicating no multicollinearity among the variables. From the results of multicollinearity test, presence of multicollinearity among the variables used in the analysis was ruled out therefore giving credence to the regression results.

4.3.3 Model Diagnostics

Various model diagnostic tests were carried out on the estimated empirical models specified for the analysis. These tests include the Hausman test to choose the appropriate specification for the panel data model; and, test of over-identifying restrictions and test of autocorrelation in the first differenced residuals to determine the applicability of GMM technique. The results of these tests are presented together with the discussion of the results of the model estimation.

4.4 Empirical Findings

This section presents the empirical findings of the study derived from the results of the model estimation. The findings are ordered as per the study objectives.

4.4.1 Growth Convergence in the East African Community

The first objective of the study was to establish the state of growth convergence among EAC member countries. Two types of convergence were investigated: absolute and conditional growth convergence. For absolute convergence, equation (3.18) was used while for conditional convergence, equation (3.19) was estimated. The study used the logarithm of GDP as the dependent variable in the estimation. Since the lag of the dependent variable is also an explanatory variable, estimating equations (3.18) and (3.19) using the static panel model estimation techniques such as, Fixed Effects (FE) or Random Effects (RE) methods would pose endogeneity problem. Endogeneity problem occurs because the lag of the dependent variable used as an explanatory variable is correlated with the error term. Therefore, the equations were estimated using one-step Arellano-Bond dynamic panel-data estimation technique which is a form of GMM estimation technique applied in the first differenced equation (Baltgi, 2008). The problem of potential endogeneity is much easier to address in the dynamic panel system GMM estimation framework than in the static models that do not allow the use of internally generating instruments from past dependent variable values (Kedir, 2017). The estimation technique was appropriate since the time component(T) is larger than the cross-sections component (N) (Roodman, 2009). Since the one-step Arellano-Bond dynamic panel estimates the first difference model, the dependent variable is, therefore, transformed into a growth rate.

4.4.1.1 Absolute Growth convergence

Absolute convergence takes place when poor economies grow faster than rich economies, thus converging to a common steady state level of income. The implication of absolute convergence is that in the long-run, countries should not only grow at the same rate but also reach the same level of income per capita (Barro & Sala-i-Martin, 1995). Table (4.2) presents the empirical findings of the absolute convergence.

Table 4. 2: Empirical results for absolute growth convergence

Dependent Variable: Log of GDP			
Explanatory Variable	**Coefficient**	**Std Error**	**P- value**
Lagged log of GDP (Convergence variable)	0.965***	0.012	0.000
Constant	0.165***	0.027	0.000
Speed of Convergence (λ)	0.199		
Half-life (Years)	3		
Full-life (Years)	23		
Wald Chi2 (1) = 6742.3***	Prob > Chi2 = 0.000		
Sargan test of Over-identifying restrictions	P-value = 0.6765		
Test of Autocorrelation	1st order: P-value = 0.0970		
	2nd Order: P-value =0.4196		

Notes: ***, ** denote statistical significance at 1 per cent

$$Speed\ of\ Adjustment\ (\lambda) = \frac{-Ln(\varphi)}{T} * 100$$

$$Half - life = \frac{Ln(0.5)}{\lambda} * 100 \ ; \quad Full - life = \frac{Ln(100)}{\lambda} * 100$$

All the variables are in logarithms.

Source: Author's computation

The empirical results of absolute growth convergence shown in Table 4.2 indicate the

variables included in the model were jointly significant in determining absolute growth convergence in EAC member states. This is because the p-value of the Wald test of overall significance was approaching zero which is less than all conventional levels of significance, rejecting the null hypothesis that the coefficients of these variables are zero. The results of the Sargan test of over-identifying restrictions which is a test of overall validity of the instruments used, shows that the p-value of the chi-square was 0.6765 which is greater than all conventional levels of significance. The null hypothesis is not rejected meaning that the instruments used in the model were valid giving support to the choice of instruments used in the study. Further, the model was tested for serial correlation in the error term using the Arellano-Bond test for zero autocorrelation in first differenced errors.

The presence of serial correlation renders the moment conditions invalid and thus, resulting in unreliable inference. The results as presented in Table A7 indicate that the hypothesis of no autocorrelation in the first order is rejected at ten per cent level of significance because the p-value is 0.097. However, since the p-value of the second order is 0.4196 which is greater than all conventional levels of significance, the hypothesis is not rejected in the second order implying that the error term is serially uncorrelated. Rejecting the null hypothesis of no serial correlation in the first-differenced errors at order one does not imply that the model is mis-specified but rejecting the null hypothesis at higher orders implies that the model is not well specified (Blundell *et al.*, 2000).

Convergence holds if the convergence coefficient is positive, statistically significant and

less than unity (Hammouda *et al.*, 2009; Asongu, 2014). The absolute convergence coefficient was found to be 0.965. The coefficient was positive, statistically significant at one per cent level of significance and less than one and thus, fulfilling the requirement of absolute convergence. Therefore, the empirical findings support existence of absolute growth convergence in EAC member countries. This implies that the relatively poorer countries in EAC were growing faster than the relatively richer ones towards the growth target of seven per cent.

The calculated speed of convergence was found to be 0.199 implying that the speed at which EAC countries were converging is at 0.2 per cent annually. The results of the study showed that at the given speed of convergence, it would take three years to eliminate half of the growth gaps among EAC countries, but it would take at least 23 years to close the growth gaps all factors held constant. The study findings, therefore, showed evidence that there was absolute GDP growth convergence in EAC countries which is a necessary condition for the formation of a monetary union as per the OCA theory. This finding is in line with Hammouda, et al. (2009) who found a positive and statistically significant coefficient of 0.391 and 0.341 for SADC and COMESA countries, respectively. This finding of absolute convergence is also affirmed by Amplatz (2003) and Szeles and Marinescu (2010) who established the existence of absolute convergence in Central and Eastern European countries between 1996 - 2000 and 1988 – 2008, respectively. Mankiw *et.al*. (1992) also established that OECD countries were converging with a coefficient of 0.341 and a convergence speed of 1.67 per cent during the period 1960-1985.

4.4.1.2 Conditional Growth Convergence

Conditional convergence was estimated using equation (3.19). Conditional growth convergence occurs when economies converge to their own steady state implying that countries that are further away from their steady state will grow at a faster rate than those nearer to it (Mathur, 2005). This occurs when the country differences are controlled for in the regression analysis. The control variables that were identified from various growth convergence literature used in the estimation included gross capital formation, human capital, trade openness, gross government debt, FDI, ODA, government consumption expenditure, population growth and exchange rate. The study also incorporated government effectiveness as institutional variable that affect GDP growth convergence. The variable was included because an efficient government enhances market efficiency for private sector to drive growth (Alam *et al.*, 2017). As observed by Alam *et. al.* (2017), government effectiveness also promotes efficient division of labour, productive investments and faster implementation of social and economic policies thus leading to higher economic growth. The estimated results of the conditional growth convergence are presented in Table 4.3.

Table 4. 3: Empirical results for conditional growth convergence

Dependent Variable: Log of GDP			
Explanatory Variables	**Coefficient**	**Std. Err.**	**P-Value**
Lagged log of GDP (Convergence variable)	0.858***	0.025	0.000
Gross Capital formation	0.106***	0.014	0.000
Human Capital	0.317***	0.122	0.010
Trade Openness	0.062***	0.025	0.013
Government Effectiveness	0.066*	0.035	0.056
Gross Government Debt	-0.038***	0.012	0.001
Foreign Direct Investments	0.006*	0.004	0.072
Official Development Assistance	-0.018	0.017	0.288
Government Consumption Expenditure	-0.071	0.044	0.109
Population Growth Rate	-0.017***	0.004	0.000
Exchange Rate	0.468***	0.161	0.004
Constant	-0.048	0.167	0.776
Speed of Convergence	0.81		
Half- Life (Years)	1		
Full – Life (Years)	6		
Wald Chi2 (4) = 49.59	Prob > Chi2 = 0.000		
Sargan test of over-identifying restrictions	P-Value = 0.152		
Arellano-Bond autocorrelation test	1st order: P-value = 0.0881		
	2nd Order: P-value =0.4033		

Notes: ***, **, * denote statistical significance at 1 per cent, 5 per cent, and 10 per cent, respectively

All the variables except government effectiveness are in logarithms.

$$Speed\ of\ Adjustment\ (\lambda) = \frac{-Ln(\varphi)}{T} * 100$$

$$Half - life = \frac{Ln(0.5)}{\lambda} * 100\ ;\quad Full - life = \frac{Ln(100)}{\lambda} * 100$$

All the variables are in logarithms.

Source: Author's computation.

The empirical results of conditional growth convergence presented in Table 4.3 indicate the variables included in the model were jointly significant in determining the conditional growth convergence in EAC countries. This is because the p-value of the Wald test of overall significance is approaching zero, which is less than the one per cent level of significance, rejecting the null hypothesis that the coefficients of these variables were jointly equal to zero. From the model specification test results, the Sargan test of over-identifying restrictions shows that the choice of instruments used was valid. This is because the p-value of the test was found to be 0.152 which is greater than all conventional levels of statistical significance and therefore, rejecting the null hypothesis that the instruments were not valid. Further, the model was free from serial correlation since the p-value of the first order autocorrelation is 0.0881 and the p-value of the second order s 0.4033 which is greater than 0.5 implying that the error is serially uncorrelated. The study made use of all the available instruments to increase the efficiency of the outcome.

The estimation results presented in Table 4.3 established that the coefficients of convergence variable, gross capital formation, human capital, trade openness, gross government debt, population growth rate and exchange rate had p-values less than 0.05 meaning that the coefficients were significantly different from zero at five per cent level of significance. The coefficients of other variables including government effectiveness and FDI were found to be statistically significant at ten per cent level of significance implying that the coefficients were statistically different from zero at ten per cent level of significance. From the study findings, it can be implied that past GDP growth, gross capital

formation, human capital, trade openness, government effectiveness, gross government debt, FDI, population growth rate and exchange rate are important factors that explain conditional GDP growth convergence in EAC.

From the empirical findings shown in Table 4.3, the coefficient of conditional convergence variable was 0.858 with a corresponding p-value of 0.000, therefore, statistically significant at one per cent level of significance. The coefficient was found to be positively significant and less than one which is a necessary requirement for GDP growth convergence. The estimation results indicate, therefore, that there was conditional GDP growth convergence in EAC countries between 2000 and 2018. The calculated speed of convergence for conditional GDP growth convergence was 0.81 implying that EAC member countries were converging towards the GDP growth target at a speed of 0.81 per cent with half-life of one year and full-life of six years.

The implication of the empirical results is that after controlling for differences in EAC countries by use of control variables that explain growth, the period it would take to eliminate half of the growth gaps is reduced from three years to one year while the time it would take to close the gaps entirely reduces from 23 years to six years. In addition, the speed of convergence increased from 0.2 per cent to 0.8 per cent annually. This speed of convergence is higher than the 0.05 per cent found by Githuku et al. (2018) in EAC but lower than the 17 per cent and 28 per cent for SADC and COMESA, respectively established by Hammouda et al. (2009) for the period 1980-2003. Ding and Knight (2011)

attributed the differences in the speed of convergence to differences in variables included in the growth convergence equation. The finding of existence of conditional convergence in EAC is also affirmed by Amplatz (2003) and Szeles and Marinescu (2010) who established the existence of the same in Central and Eastern European countries between 1996 - 2000 and 1988 – 2008, respectively. However, Asongu (2014) established lack of convergence in West and East Africa between 1981 and 2009. The lack of convergence was attributed to differences in policies in the respective countries.

From the foregoing analysis, the study therefore, established existence of both absolute and conditional GDP growth convergence among the EAC countries. This means that the theory of convergence is applicable in the context of the EAC partner states. It shows that there is catching-up between the relatively poor and rich countries in the EAC. The results of the study further imply that there has been a decline in GDP growth variations among the EAC member states over the period 2000 – 2018. According to the neoclassical growth theory, poorer countries should grow faster and eventually catch-up with the richer countries, a proposition that holds for EAC member states.

The coefficient of gross capital formation was 0.106 and statistically significant at one per cent level of significance. This means that gross capital formation positively influences GDP growth convergence in EAC. The coefficient of 0.106 implies that a one per cent increase in gross capital formation would increase GDP growth by 0.106 per cent in EAC holding all other factors constant. According to Solow (1956), accumulation of capital

contributes to increase in the level of production thus, boosting economic growth. Accumulation of capital would therefore, help the EAC countries grow their economies thus aiding them to get closer to the GDP growth target of seven per cent.

Kedir (2017) studied drivers of economic growth in Africa and found that gross fixed capital formation had a positive and statistically significant effect on economic growth. Other studies that support this finding include Githuku et.al. (2018), Ongo and Vukenken (2014) and Roe and Diao (2004). The variability of capital in EAC economies particularly in infrastructure is substantial and this, may hamper their growth. ECA (2015) observes that a major impediment to Africa's economic growth is the high variability of infrastructure among the individual economies. This is because the differences translate to high transportation costs making the African economies not competitive. The implication thus is that investment in physical capital in EAC economies would significantly reduce the transportation costs, enhance trade as well as attract investments thus contributing more to economic growth and convergence to a monetary union.

The coefficient of human capital was 0.317. The variable was proxied by the mean years of schooling. The coefficient was positive and statistically significant at one per cent level of significance. From the empirical findings, a one per cent increase in the mean years of schooling would result to a 0.317 per cent increase in GDP growth in EAC. These findings are in line with the neoclassical growth theory, which predicts a positive relationship between human capital and economic growth. The neoclassical growth theory postulates

that investment in human capital through education, research and development can affect growth. Romer (1990) also aver that education promotes growth through technology absorption and innovation. According to Cortright (2001), knowledge and technology are characterized by increasing returns and it is the increasing returns that drive the growth process. It is the differences in human capital investments in regional economies, that may cause growth differentials between countries to persist (Cortright, 2001).

This study finding confirms the results by Kartal *et al.*, (2017), Alataş and Çakir (2016), Izushi and Huggins (2004) and Akpolat (2014) who established a positive effect of human capital on economic growth. According to Alatas and Cakir (2016), the positive effect of human capital on economic growth is two-fold. First, human capital participates directly in the production process as a productive factor. In this sense, accumulation of human capital would directly generate the growth of output. Second, human capital can contribute to raising technical progress and, in this way, the level of human capital affects productivity growth. Izushi and Huggins (2004) observes that knowledge has non-excludability attributes in that its use by one firm does not limit the use by another. Thus, the non-excludability nature of knowledge allows researchers to share knowledge and act on it to create new ideas. These new ideas are then embodied in the production processes bringing about economic growth.

There are, however, studies such as Benhabib and Spiegel (1994), Pelinescu (2015) and Pritchett (2001) that have established a negative effect of human capital on growth. These

studies have attributed the negative effect to the heterogeneous nature of the countries that were analyzed and their level of economic development, differences in skills needed in the labour market as well as measurement errors.

The coefficient of trade openness variable was found to have a coefficient of 0.062 and statistically significant at one per cent level of significance. This means that trade openness would positively influence income convergence among EAC partner states. From the study findings, a one percentage change in trade openness in EAC would change GDP growth by 0.062 per cent *ceteris paribus*. Trade openness was measured by the sum of imports and exports of goods and services as a share of GDP. The study results confirm the finding by Anyanwu (2014) who established a positive and significant association between trade openness and economic growth in China. According to Anyanwu (2014), trade openness would affect growth of an economy through various channels. These include exploitation of comparative advantage, technological transfer and diffusion of knowledge, increased economies of scale as well as increased competitiveness. These factors can be attributed to the positive relationship between trade openness and GDP growth in EAC.

The empirical findings presented in Table 4.3, indicate that the coefficient of policy variable namely government effectiveness was 0.066. The coefficient was found to be positive and statistically significant at ten per cent level of significance. The variable captures the perception by citizens on the capacity of government to effectively formulate and implement sound policies, and the credibility of the government's commitment to such

policies. It is a proxy for governance (Kaufmann *et al.*, 2011). The coefficient of 0.066 implies that if the perception about government's credibility of formulation and implementation of sound economic policies would improve by one percentage point, the economic growth among EAC member countries would increase by 0.066 per cent holding all other factors constant. This finding of the study shows that government effectiveness is an important factor in aiding growth convergence in EAC. This finding is in line with Alam *et. al.* (2017) who found a positive coefficient of 0.68 in a panel of 81 countries both developing and developed.

The coefficient of gross government debt variable was -0.038. The coefficient of the variable was negative and statistically significant at one per cent level of significance. The results show that a one per cent increase in gross government debt would reduce GDP growth by 0.038 per cent in EAC *ceteris paribus*. Thus, government debt affects GDP growth convergence in EAC negatively. Studies on public debt and economic growth have established such inverse relationship between government debt and economic growth. Shkolnyk, and Koilo (2018), Panizza and Presbitero (2013), Checherita and Rother (2012) as well as Afonso and Alves (2014) all have established that government debt has a negative effect on economic growth both in developed and developing economies.

Public debt affects growth negatively through avenues such as crowding out the private sector, increased interest rate thus discouraging investments and inefficiency of a country to manage borrowed funds (Shkolnyk, & Koilo, 2018). One of the possible reasons for

negative effect of public debt on economic growth in EAC is the mismanagement of borrowed funds (Babu *et al*., 2015). In addition, the borrowed funds may not have been directed to productive sectors but rather, may have been channeled to repayment of debt and recurrent expenditures that are non-productive in nature.

Some studies such as Burhanudin *et. al.* (2017), Gómez and Sosvilla (2017) and Spilioti (2015) have found a positive effect of public debt on economic growth. These studies have attributed the positive effect of government debt on economic growth on the extent and nature of utilization of the funds on productive sectors. According to these studies, the channeling of funds to productive sectors would enhance productivity and create employment which stimulates demand thereby, contributing to growth positively. Thus, channeling of debt to productive sectors of the economies in EAC and prudent management of the borrowed funds would ensure increased productivity and economic growth thus aiding convergence towards a monetary union in the EAC member countries.

The coefficient of FDI was found to be 0.006. The coefficient was positive and statistically significant at ten per cent level of significance. From the study findings, FDI is positively related to GDP growth convergence in EAC. The coefficient of 0.006 implies that a one per cent increase in FDI would increase GDP growth in EAC by 0.006 per cent holding all other factors constant. A number of studies have supported the positive effect of FDI on economic growth. The studies include Melnyk and Pysarenko (2014), Ek (2007) and Siddique *et al.* (2017). These studies have argued that FDI influences the host economy's

growth through the transfer of new technologies and know-how, formation of human resources, integration in global markets, increase of competition, and firms' development and reorganization. This implies that appropriate business environment to facilitate transfer of technology and managerial skills by foreign firms, and encouraging re-investment of profits would be necessary for FDI to positively impact growth in EAC and aid these countries to convergence towards a monetary union.

Baiashvili and Gattini (2020) studied the effect of FDI inflows on economic growth among 111 developed and developing countries between 2001 and 2014. The study found that FDI had positive effect on economic growth across these countries. The positive effect was attributed to institutional factors such as rule of law, government effectiveness, control of corruption and regulatory quality particularly in developing economies. The EAC countries can, therefore, improve their economic performance by attracting more FDI through enhancing institutional factors as well as creating an enabling environment that would be attractive to FDI.

Other studies such as Rahman (2015), Dinh and Nguyen (2019), Toulaboe *et. al.* (2009) and Umeora (2013) have found a negative relationship between FDI and economic growth. These studies have ascribed the negative effect of FDI on GDP growth to factors such as unskilled labour force, inadequate infrastructure and slow privatization process. Others are inefficient bureaucracy, political instability, recurring natural disasters, corruption and lack of transparency as well as absorptive capacity of the recipient country.

Further, the study findings established that the coefficient of government consumption expenditure variable was -0.071 but statistically insignificant. This implies that the coefficient was not statistically different from zero and thus, the variable was not important in explaining conditional growth convergence in EAC. Studies on the effect of government spending on economic growth has yielded mixed results. A study by Landau (1986) on government consumption expenditure and economic growth in developing economies between 1960 and 1980 found that government consumption expenditure had a negative and statistically significant effect on GDP growth. Sjoberg (2003), studied effect of government expenditure on economic growth in Sweden between 1960 and 2001 and found an inverse relationship. According to Sjoberg (2003), increase in government spending may be financed through increase in taxes or borrowing. Increase in taxes will lower disposable income for households and private consumption will fall accordingly. This would in turn lead to reduced demand thus, affecting economic growth negatively. On the other hand, increased government spending financed through borrowing is likely to crowd out private investments as government takes the resources that would have been used for private investments. The crowding-out effect takes resources away from productive activities to less productive ones because government will not allocate resources or provide goods more efficiently than the private sector leading to negative effects on economic growth.

Other studies on government expenditure and economic growth such as Ghosh and Gregoriou (2006), Devarajan *et al.* (1996) and Wahab (2011) have supported the view of

existence of positive effect of government consumption expenditure on economic growth. These studies have attributed the positive effect of government consumption expenditure on growth to demand stimulation through fiscal policies. The increase in government consumption expenditure forces firms to increase production of the demanded goods and services and as a result, output and employment increases which stimulates more demand and consequently improving output in the economy. The differences in fiscal policies between EAC countries may have contributed to the insignificance of the coefficient of the variable.

The coefficient of population growth rate was found to be -0.017. The coefficient of the variable was statistically significant at one per cent level of significance implying population growth rate negatively influences GDP growth convergence among EAC partner states. As reported in Table 4.3, a one per cent increase in population growth rate would lead to a 0.017 per cent decline in GDP growth in EAC. Studies on the effect of population growth on economic growth has yielded mixed results. Peter and Bakari (2018) found that population growth had positive impact on economic growth in 53 African countries between 1980-2015. However, this contradicts the findings of Klasen and Lawson (2007), who established a negative effect of population growth on economic growth in Uganda. Other studies that have found negative association between population growth and economic growth include; Dao (2012), Birdsall *et al.* (2001), Barro and Sala-i-Martin (2004), Sachs (2008), and Headey and Hodge (2009).

Population growth forces economies to utilize their scarce savings to undertake capital widening rather than capital deepening (Klasen & Lawson, 2007). High population growth also increases dependency which eats into the savings and thus reducing investments that are required for economic growth (Peterson, 2017). The EAC's population is largely youthful with 33 per cent of the population falling between 15-35 years in 2015. Thus, much resources are directed towards building capacities of the youthful population as evidenced by high proportions of education budgets. A high proportion of this youthful population is unemployed and therefore, not productive. This leads to high dependency, low savings and investments which slows economic growth. Thus, the diversion of resources to education and healthcare for the high youthful population and dependency effects would probably explain the negative effect of population growth on economic growth in EAC.

The coefficient of ODA was -0.018 and statistically insignificant. This means that the coefficient was not statistically different from zero implying that the ODA variable was not important in explaining growth convergence in EAC. Official development assistance is important for supplementing domestic resources thereby, relieving domestic savings and foreign exchange constraints of recipient economies. As observed by Ekanayake and Chatrna (2010), the main role of foreign aid in stimulating economic growth is to supplement domestic finance and thus increasing investment and capital stock. According to Yiew and Lau (2018), ODA can impact growth in a number of channels. These include increased investment in physical and human capital, increased capacity to import capital

goods or capital and through increased technological transfer that improves productivity of capital and promote endogenous technical change.

The estimation results for ODA variable was contrary to *apriori* expectation as the variable was expected to influence economic growth positively. This is because of the role of ODA to supplement domestic resources and thus stimulating economic growth through increased investments. A study by Phiri (2017), on the impact of aid on economic growth of developing countries in Sub-Saharan Africa between 1995–2014, established a negative and insignificant coefficient. According the Phiri, the negative effect of ODA on economic growth can be associated to a number of reasons. Firstly, foreign aid may create a dependency syndrome that weakens the government's effort of collecting revenue. Secondly, large inflows of foreign currency can strengthen the recipients' domestic currency and raise its export prices, in turn making the country less competitive in the global market.

Foreign aid inflows may have an effect of reducing long-run capital accumulation and labour supply of recipient countries (Gong & Zou, 2001). This limits the countries' potential to generate higher rates of economic growth. Yiew and Lau (2018) observe that foreign aid may result into appreciation of real exchange rate in the recipient country. This affects the balance of trade position and imposes the long run risk to overall economic performance. According to Yiew and Lau (2018), sound macroeconomic environment, good institutional quality, and low level of corruption are pre-requisite conditions for aid

to have positive influence on economic growth. Therefore, the negative effect of ODA on economic growth in EAC could be due to failure of aid recipient governments to appropriately manage and allocate aid funds in their most productive sectors. In addition, the relatively high deviations of ODA variable across EAC countries may account for the insignificance of the coefficient.

The coefficient of exchange rate variable was found to be 0.468. The coefficient was positive and statistically significant at one per cent level of significance meaning the coefficient was statistically different from zero at one per cent level of significance and, therefore, an important variable in explaining growth convergence in EAC countries. The coefficient of 0.468 implies that an exchange rate appreciation of one per cent in EAC countries will lead to a 0.468 per cent increase in economic growth holding all other factors constant. Studies on the effect of exchange rate on economic growth have yielded mixed results.

A number of studies on exchange rate and economic growth have supported a positive effect of exchange rate on economic growth. Aman *et al.* (2017) found that exchange rate had a positive association with economic growth in Pakistan between 1976 and 2010. The study demonstrated that exchange rate can stimulate economic growth through the channel of export promotion, enlarging the volume of investment and improving FDI inflow which results from depreciation of domestic currency. The depreciation of exchange rate discourages imports, increases exports and thus, promotes import substitute industries. The

promotion of import substitute industries as well as increased exports creates employment which enhances economic growth.

The effect of exchange rate on economic growth may be hampered by the level of financial systems in place in the respective economies. Ashour and Chen (2018) found that exchange rate had a positive effect on economic growth that depended on the level of financial development among developing economies for the period 1974–2006. The study observed that countries lacking advanced financial systems are deprived from enjoying the benefits of the flexible exchange rate regime.

The study, therefore, established that there is existence of absolute and conditional GDP growth convergence among EAC member countries. This means that the hypothesis of poor countries catching-up with the rich countries is acceptable among the EAC partner states. The study also found that future growth endeavors for growth convergence in EAC should focus on gross capital formation, human capital, trade openness, government effectiveness, government debt, FDI, population growth and exchange rate.

4.4.2 Convergence of Monetary Variables in the East African Community

The second objective of the study was to evaluate the state of convergence of monetary variables in the EAC member countries. In this study, monetary variables include exchange rate and inflation rate as per the macroeconomic convergence criteria set by the EAC member countries.

4.4.2.1 Convergence in Exchange Rate

The macroeconomic convergence criteria require convergence of exchange rate variable for countries envisaging to form a monetary union. The EAC convergence criteria had set a target of stable exchange rate that was to be achieved by 2007 and to be maintained thereafter. To analyze convergence in exchange rate in the EAC member countries, equations (3.22) and (3.23) were estimated. Equation (3.22) estimated the sigma convergence where the standard deviation of exchange rate from the five EAC member states was used for the period 1980-2018. Sigma convergence is purely a time series analysis and, therefore, this time period was considered to provide adequate observations for time series analysis. The study used a dummy variable to take care of the policy effect before and after the regional integration process in EAC.

To test for stationarity and hence stability of exchange rate, each series was tested for unit root using Clemente-Montanes-Reyes (CMR) test of unit root. The CMR is a test that allows for two different forms of structural breaks known as Additive Outlier (AO) and Innovational Outlier (IO). The AO assumes that changes take place rapidly allowing for a break in the slope and the IO assumes changes take place gradually and allows for a break in both the intercept and the slope (Clemente, Montanes & Reyes, 1998). The CMR test was preferred to Augmented Dickey–Fuller (ADF) and Phillip Perron (PP) unit root test since the latter two tests may fail to reject the unit root hypothesis if the series have a structural break (Clemente *et al*., 1998). Thus, testing for unit root while allowing for structural breaks may prevent the test results from bias that may reduce the ability to reject

a false hypothesis. The CMR tests the null hypothesis of unit root presence with structural breaks against the alternative of no unit root. Failure to reject the null hypothesis means that the series is non-stationary and thus, not stable. The CMR unit root test results are presented in Table A10.

From Table A10, the exchange rates for Burundi, Kenya and Uganda were not stationary since the test-statistic was greater than the critical value at five per cent level of significance while the exchange rate or Rwanda, and Tanzania were stationary. From the unit root test results, it can be concluded that Burundi, Kenya and Uganda experienced unstable exchange rates while Rwanda and Tanzania had stable exchange rates. The unit root test for the standard deviation of exchange rate had a test-statistic of -6.073 in the IO model which is less than -5.490 critical value and therefore was found to be stationary at five per cent level of significance. The analysis of sigma convergence in exchange rate was therefore carried out with the variable with no manipulation since it was stationary at levels. Sigma convergence is confirmed if the coefficient of time variable is negative and statistically significant. The estimation results of sigma convergence are presented in Table (4.4).

Table 4. 4: Estimation results of sigma convergence in exchange rate

Dependent Variable: Standard Deviation of Exchange Rate			
Explanatory Variables	**Coef.**	**Std. Err.**	**P-Value**
Time (Sigma convergence)	-0.009***	0.003	0.006
Dummy	0.101	0.075	0.184
Constant	0.191***	0.430	0.000
Prob > F	0.0027		
R - Squared	0.2339		

Notes: ***, denote statistical significance at 1 per cent
Source: Own computation from study data.

The estimation results presented in Table (4.4) indicate that the variations in the standard deviation of exchange rate from 1980 to 2018 are explained by time variable. This is because the p-value of the overall test of significance (F-test) was approaching zero which is statistically significant at one per cent level of significance. The R-squared indicates that about 23.39 per cent of variations in standard deviation of exchange rate are explained by time. The results of the study indicate that the coefficient of time variable was -0.009. The coefficient was negative and statistically significant at one per cent level of significance. This means that exchange rates among the EAC member states were converging. This is because the dispersion of exchange rate among the EAC member states' currencies was declining with time.

The OCA theory requires that countries planning to enter into a monetary union should have stable currency exchange rate with reduced variations in order to ensure successful monetary union. The convergence of exchange rate means that exchange rate uncertainty

is reduced. The reduction in exchange rate volatility imply reduction of cross-border transaction costs and thus, increased capital mobility and intra-regional trade, thereby, boosting growth and helping per capita income levels to converge between poor and richer countries (Franks et al., 2018).

In order to explain the drivers of exchange rate differences in EAC, equation (3.23) was estimated using panel data. The dependent variable in the estimation was the deviation of exchange rate taken from the numeraire country as per the OCA theory. In this case, Kenya was taken as a numeraire country since it is the biggest economy among EAC member states to which other economies within the region should converge, for a successful monetary union. Equation (3.23) allows for other variables that influence variability of exchange rate. The other variables included are asymmetry of business cycles, trade structure, bilateral trade, economic size and government effectiveness.

From the Hausman test of model specification presented in Table A3, the null hypothesis of the preferred model is random effects could not be rejected since the p-value of the test was 0.99 which is higher than 0.05 significance level. Therefore, the appropriate model identified for the estimation was the random effects model. The estimation results of deviations in exchange rate among the EAC member states is presented in Table 4.5.

Table 4. 5: Estimation results for exchange rate deviations in EAC

Independent Variable	**Exchange rate Deviations**		
Explanatory Variables	**Coefficient**	**Std. Err.**	**P-Value**
Time variable (t) (Convergence variable)	-0.007***	0.002	0.001
Business Cycles Asymmetry	1.511***	0.212	0.000
Trade Structure	0.002	0.002	0.290
Bilateral Trade	-1.632**	0.676	0.016
Government Effectiveness	0.070*	0.038	0.063
Economic Size	0.033**	0.014	0.022
Constant	0.045*	0.024	0.059
Wald Chi2 (7) = 64.31	P-value =0.000		
Hausman Test	0.99		
R-Squared	Within	0.5371	
	Between	0.9709	
	Overall	0.5421	

Note: ***, **, * denote statistical significance at 1 per cent 5 per cent, and 10 per cent, respectively
Source: Own computation from study data.

From the empirical results presented in Table 4.5, the overall significance indicates that the coefficients of random effects model are together statistically significant since the p-values of the Wald test is around zero which is less than the one per cent level of significance. Thus, the variables jointly explain the deviations of exchange rate in EAC member countries. The overall R-squared was found to be 0.5421 implying that 54.21 per cent of variations in exchange rate can be explained by the variables included in the model.

The coefficients of all the variables were found to have the expected signs. The coefficient

of time and coefficient of business cycles asymmetry were statistically significant at one per cent level of significance. In addition, the coefficients of bilateral trade and economic size were statistically significant at five per cent level of significance while the coefficient of government effectiveness was found to be statistically significant at ten per cent level of significance. This means that the coefficients of these variables are statistically different from zero at one per cent, five per cent and ten per cent level of significance, respectively. The implication is that business cycles asymmetry, bilateral trade, economic size and government effectiveness are important variables that explain exchange rate variations in the EAC member countries. Furthermore, the deviations of exchange rate referencing from the biggest economy that is Kenya, are observed to decrease with time since its coefficient is significantly negative.

The results shown in Table 4.5 confirm that differences in exchange rate among EAC countries was declining with time. The coefficient of time which is the convergence coefficient was found to be negative and statistically significant at one per cent level of significance. The negative sign implies that the annual changes in the exchange rate among the EAC member countries' currencies were declining with time. This result is consistent with the evidence of sigma convergence from the earlier estimated model. Further, this finding is also consistent with the results of Kendall (2000) who established that there was exchange rate convergence in the CARICOM between 1967 and 1996. De Grauwe and Heens (1993) also observed exchange rate convergence in four countries namely; Germany, Netherlands, Spain and United Kingdom between 1965 and 1985.

Papiashvili (2009) while analyzing the political economy of monetary integration in the transition economies observed that similarity of exchange rates enhances financial integration thus reducing the necessity for exchange rate adjustments. The effect is reduced differences in long-term interest rates and would facilitate the financing of external imbalances. De-Grauwe and Heens (1993) observed that stable exchange rate among countries envisaging to enter into a monetary union ensures that if there are shocks experienced in the respective economies, it would not require changes in real exchange rate to address the shocks. Less variability in exchange rate would thus, ensure the cost of individual member countries losing their currencies is small (De-Grauwe & Heens, 1993). Akiba (2007) argued that with stable exchange rate, the benefits of forming a monetary union would be more than the costs thus making it profitable for countries to form monetary unions.

The empirical findings confirm that differences in exchange rate among the EAC member states was declining as per the OCA theory. The means that the exchange rate variability in EAC was declining an indication of exchange rate stability within the region. This implies that it would be possible for the regional monetary authority to effectively manage exchange rate stability in case of a monetary union. The convergence of exchange rate in EAC member countries is an indication of reduction in the volatility of exchange rate and thus, a reduction in uncertainty. As a result, cross-border transaction costs would decline, therefore, creating appropriate conditions for increased capital mobility and intra-regional trade. More capital flow and increased trade would boost economic growth thus, making a

monetary union more beneficial to the member countries.

The coefficient of business cycles asymmetry variable was found to be 1.51 with a p-value of less than 0.01. Thus, the coefficient was statistically significant at one per cent level of significance. The variable captures the output gap between the EAC member countries taken with Kenya as the reference country. The variable measures the similarity of cyclical component of output between the EAC member countries. The positive relationship between exchange rate variability and the business cycles asymmetry in EAC member countries means that all other factors held constant, a one per cent increase in business cycles asymmetry would lead to a 1.51 per cent increase in exchange rate variability. This means that as the output gap among EAC countries increases, the volatility of exchange rate in these countries will increase. The OCA theory requires that countries forming a monetary union should exhibit similarity in business cycles for the monetary union to be successful. Countries that do not differ significantly in the cyclical component are candidates for a monetary union (Sheik *et al*., 2011). The findings of positive effect of business cycles asymmetry on exchange rate variability is consistent with the OCA theory. The asymmetry of business cycle has been identified as a necessary condition for an optimal monetary union according to the OCA theory (Botto, 2018). The asymmetry of business cycles makes it easier for the regional central bank to conduct stabilization policies (Belke *et.al*., 2017). These results are confirmed by Bayoumi and Eichengreen (1997), who established a positive relationship in the European Union countries.

The findings are also consistent with Duarte, Restuccia and Waddle (2007) who established a positive relationship between exchange rate volatility and business cycles in 36 countries, 19 developed and 17 developing, between 1975 and 1998. Knobel and Mironov (2015) observed that greater business cycle synchronization would reduce integration costs, increase potential gains, and support sustainable development of the monetary union in the future in Commonwealth of Independent States (CIS) countries. Other studies such as Rose (2008) and Gumus and Taşpınar (2015) supported positive effect of business cycles on exchange rate volatility.

From the study findings, business cycles play a crucial role in determining the future success of a monetary union. Reduced business cycles will ensure reduced exchange rate variability which in turn will minimize the cost of entering into a monetary union thus making it viable. This implies that alignment of productive activities minimizes business cycles in a group of countries forming a monetary union. When business cycles across economies are synchronous, the cost of using a single currency is reduced because, *ceteris paribus,* there is less need for asymmetric monetary policy responses to shocks (Botto, 2018). According to Botto (2018), a unified monetary policy is not optimal if parts of a monetary union are experiencing expansion while other areas are going through recession. If union member states' economies are not synchronized, then different policies would be required to bring the major economic indicators in these economies on the optimal path (Kovacic & Vilotic, 2017).

The relationship between bilateral trade and exchange rate deviations in EAC turned out to be negative as expected. The coefficient of bilateral trade variable was -1.63 and statistically significant at five per cent level of significance. This means that a one percentage point increase in bilateral trade would decrease exchange rate volatility by 1.63 per cent holding all other factors constant. This finding is consistent with Grier and Smallwood (2007), who found a statistically significant negative effect between trade and exchange rate volatility in a sample of nine developing and nine developed countries. Exchange rate uncertainty has a negative impact on export growth for the majority of less developed countries (Grier & Smallwood, 2007).

According to Rose (2008), trade expansion brings about business cycles synchronization, and reduces the exchange rate volatility making it easier for member countries to pursue a common monetary policy. Dell'Ariccia (1999) also established that exchange rate volatility had negative effects on international trade in Western Europe from 1975 to 1994. If exchange rate movements are not fully anticipated, an increase in exchange rate volatility, which increases risk, will make risk-averse agents to reduce their import or export activities and to re-allocate production towards domestic markets. Dell'Ariccia (1999) asserts that the establishment of European Monetary System (EMS) was to control exchange rate volatility and avoid large misalignments among European currencies. The purpose was to reduce exchange rate uncertainty so as to promote intra-EU trade and investments. According to Krugman (1993), increased specialization would bring about higher trade and reduce the asymmetry of business cycles in a monetary union. Therefore, from the study

findings, convergence of exchange rate in EAC member countries will be successful if there is exchange rate certainty and increased trade among the member countries.

From the empirical results presented in Table 4.5, economic size was found to have a positive and significant effect on exchange rate deviations, which is consistent with the OCA theory. According to the estimation results, a one per cent increase in economic size would bring about a 0.033 per cent increase in exchange rate deviations. Economic size is a measure of the benefits of a stable currency that accrue to economies in a monetary union. McKinnon (1963), emphasizes on the degree of openness and size of the economy as crucial criteria for joining a currency union. Bayoumi and Eichengreen (1997), argued that economic size should be positively related to exchange rate variability to reflect the concept that smaller countries will benefit more from the stability of a single currency area. The implication is that as the poor economies in EAC grow faster as per the endogenous growth theory, the size of the regional economy would increase thus increasing the benefits of the EAMU. As the economies increase in size, the variations in exchange rate in these countries will be stable making the common currency union feasible.

The coefficient of government effectiveness variable was found to be 0.07 and statistically significant at ten per cent level of significance. This means that an increase in the variation of government effectiveness in EAC by one index would increase exchange rate variations by 0.07 per cent *ceteris paribus*. The implication is that if EAC governments formulated and implemented quality policies particularly monetary policies, and remained committed

to such policies, they would realize stable exchange rates. This will ensure convergence of exchange rates, which is a necessary requirement for success of monetary unions as per the OCA theory.

The study results indicated that the coefficient of trade structure variable was positive and statistically insignificant. The variable was used to measure the differences in trade structures among EAC partner states. It explains the dissimilarity of export commodity structure which is important in enhancing trade integration. Dissimilar export commodity would be beneficial in a monetary union since it facilitates the exploitation of a countries comparative advantage. Bayoumi and Eichengreen, (1998) observed that countries that had dissimilar export commodity structure were better placed to gain more by exchange rate convergence through increased trade. The EAC member states mostly export agricultural commodities and may, therefore, not exhibit high dissimilarity in export commodity structure a factor that may account for the insignificance of the coefficient.

The study results, therefore, show evidence of exchange rate convergence in EAC member countries as per the requirement of the macroeconomic convergence criteria and the OCA theory. The asymmetry of business cycles, bilateral trade, economic size and government effectiveness are the variables that were found to influence the variations of exchange rate in EAC member countries.

4.4.2.2 Convergence in Inflation Rate

The EAC macroeconomic convergence criteria required each member country to maintain an inflation rate of less than 5 per cent from 2007 to 2013 when the introduction of a single currency was expected to be effected in the region. The OCA theory specifies that countries aspiring for a monetary union should have similar inflation rate pattern. To analyze the state of inflation rate convergence in EAC, equations (3.22) and (3.23) were estimated. Equations (3.22) investigated the sigma convergence in inflation rate among the EAC member states while equation (3.23) analyzed the deviations of inflation rate in EAC. Equation (3.22) and (3.23) were estimated using OLS and panel data estimation techniques, respectively. In the panel data analysis, the deviations were taken from Kenya as the numeraire country following the OCA theory.

To analyze the sigma convergence in inflation rate among EAC partner states, the standard deviation of inflation rate was calculated and regressed against time. Sigma convergence is confirmed if the coefficient of time variable is negative and statistically significant. The series was tested for unit root using CMR unit root test before regression was done. From the CMR unit root test results shown in Table A10, the calculated test-statistic for the standard deviation of inflation rate was -6.595 and -6.314 for the AO and IO models, respectively. The test-statistic was less than -5.490 critical value at five per cent level of significance. The null hypothesis of unit root presence was therefore rejected and the conclusion was that the series was stationary at five per cent level of significance. The estimation results of sigma convergence are presented in Table (4.6).

Table 4. 6: Estimation results of sigma convergence in inflation rate

Dependent Variable: standard Deviation of Inflation Rate			
Explanatory Variables	**Coef.**	**Std. Err.**	**P-Value**
Time (Sigma convergence)	-0.172**	0.070	0.018
Dummy	-4.253***	1.606	0.012
Constant	12.688***	0.925	0.000
Prob > F	0.000		
R - Squared	0.711		

Note: ***, **, * denote statistical significance at 1 per cent, 5 per cent, and 10 per cent, respectively
Source: Own computation from study data.

The estimation results presented in Table (4.6) indicate that the overall test of significance (F-test) was statistically significant at one per cent level of significance. This implies that the variables in the model jointly influence the convergence of inflation rate in EAC. The R-squared indicates that 71.1 per cent of variations in standard deviation of inflation rate are explained by time and the dummy variables. The coefficient of time variable was -0.172 and statistically significant at five per cent level of significance. Since the variability of inflation rate in EAC member states was declining with time, it is an evidence of inflation rate convergence among these countries. The OCA theory requires that countries planning to enter into a monetary union should have minimal variations in inflation rate to ensure success of the monetary union. The convergence of inflation rate will ensure success of common currency as well as harmonize macroeconomic policies for the individual countries (Karanasos *et al*., 2016).

To investigate factors that affect variations of inflation rate in EAC, the study estimated equation (3.23) using panel data from 2000-2018. The deviations of inflation rate with Kenya as the reference country was used as the dependent variable and the explanatory variables that were included in the model were exchange rate, output gap, bank credit to private sector, broad money supply, interest rate, price level and government effectiveness. To identify the appropriate model to use in the analysis, Hausman test was carried and results are presented in Table A4. The results of the model specification test reveal that the appropriate model was the random effects model. This is because the p-value of the test was 0.5206 which is greater than 0.05 and thus, the hypothesis that random effects model is more appropriate cannot not be rejected. The estimation results of the random effect model are presented in table (4.7).

Table 4. 7: Estimation results for inflation rate deviations

Dependent Variable: Inflation Rate Deviations			
Independent variables	**Coefficient**	**Std. Err.**	**P-Value**
Time Variable	-0.081**	0.041	0.048
Exchange Rate	-0.642***	0.208	0.002
Output gap	0.125**	0.060	0.037
ΔBank Credit to Private Sector	-0.197**	0.084	0.019
Broad Money Supply	0.400***	0.100	0.000
Interest Rate	-0.056*	0.035	0.108
ΔPrice level	0.002	0.051	0.970
Government Effectiveness	-2.857**	1.406	0.042
Constant	4.694***	0.502	0.000
Wald Chi2 (8) = 52.60	Prob > Chi2 = 0.0000***		
Hausman Test: H_0: Random Effects model is the most appropriate			P- value = 0.5206
R Squared		Within	0.4938
		Between	0.1824
		Overall	0.4550

Note: ***, **, * denote statistical significance at 1 per cent 5 per cent, and 10 per cent, respectively

Source: Own computation from study data.

The empirical results in Table 4.7, indicate that the Wald test of overall significance was statistically significant at one per cent level of significance. This means that the coefficients of the variables in the model were statistically different from zero and, therefore, the variables were jointly significant in explaining the variation of inflation rate in EAC. In addition, all the variables exhibited the expected signs. The study also found that on average, 45.5 per cent of the variations in inflation rate among EAC member countries can be explained by changes in the variables included in the model.

The coefficients of exchange rate and broad money supply were found to be statistically significant at one per cent level of significance. Output gap, bank credit to private sector and government effectiveness had coefficients with a p-value of 0.037, 0.019 and 0.042, respectively meaning that the coefficients were statistically significant at five per cent level of significance. In addition, the coefficient of interest rate was found to be statistically significant at ten per cent level of significance. Therefore, the study established that exchange rate, broad money supply, output gap, bank credit to private sector, interest rate and government effectiveness are important variables that explain the convergence of inflation rate among EAC countries.

The coefficient of time variable was found to be -0.081 and was statistically significant at five per cent level of significance. As expected, the coefficient of this variable was negative and less than one, implying that deviations in inflation rate in EAC were declining with time and thus, suggesting inflation rate convergence. The OCA theory requires that

countries envisaging to form a monetary union should exhibit similarity in inflation rate for success of monetary union across the region. The convergence of inflation rate was incorporated in the convergence criteria in Maastricht treaty as one of the requirements to admit a prospective country as a full member of EMU (Kočenda & Papell, 1997). Inflation rate convergence is important in that it ensures optimal effectiveness of a common monetary policy for macroeconomic stabilization. According to Karanasos *et al*. (2016), convergence of inflation rate will ensure success of common currency as well as harmonizing macroeconomic policies for the individual countries. Kocenda and Papell (1997) confirmed inflation convergence in EMU between 1979 and 1992. Brož and Kočenda (2018) also, established presence of inflation rate convergence in the EU over the period 1999–2016.

The coefficient of exchange rate variable was -0.642 and statistically significant at one per cent level of significance. This means that on average, a one percentage point appreciation of EAC currencies to the US dollar would reduce inflation rate variations in EAC by 0.642 percentage points *ceteris paribus*. The study findings show that currency appreciation is inversely related to inflation rate variations in EAC. This is consistent with the finding of Horvath and Koprnicka (2008) who established that exchange rate appreciation contributed inversely to inflation rate convergence in EU member states during 1997-2006. Mose and Kaboro (2019) also established that convergence in inflation rate reduced exchange rate variability within Sub-Saharan region in the period 2000-2016. Thus, a fall in EAC countries' currency against the dollar implies that the region's exports become cheaper

while imports are more expensive. This will lead to cost-push inflation due to decline in supply as a result of increase in production costs (Honohan & Lane, 2003). This is because EAC countries are net importers of both finished product and inputs to the production process.

The coefficient of output gap variable was found to be positive and statistically significant at five per cent level of significance. From the regression results shown in Table 4.7, the coefficient of output gap variable was 0.125 implying that an increase in output gap by one per cent would increase inflation variations by 0.125 percentage points in EAC member countries all other factors held constant. This means that higher output gap results in more inflationary environment. Widening of inflation gaps from desired level would result to higher costs of production and consequently lower output. The decline in output would result in excess demand which pushes the prices up and hence expanding the inflation gap (Karanasos et al., 2016). The OCA theory requires similarity in output for countries with an ambition of forming a monetary union. The neoclassical growth theory also requires that poor countries should grow at a faster rate than the rich countries. The implication of the neoclassical growth theory is that as the poor economies among the EAC member states grow faster than the richer economy, the output gap among these countries will decline and consequently reduce the inflation variability. The catching-up process is expected to improve inflation convergence in EAC partner states. Thus, for EAC countries to move towards a monetary union, the outputs of all the other EAC countries should grow much more than the numeraire country which is Kenya. This will reduce their output gap in line

with the neoclassical growth theory which asserts that poor countries should grow faster than rich ones for convergence.

The coefficient of change in bank credit to private sector variable was found to be negative and statistically significant at five per cent level of significance. The magnitude of 0.197 means that on average, a one percentage point increase in bank credit to private sector, would be associated with a 0.197 percentage points reduction in the variability of inflation rates within the EAC member states *ceteris paribus*. The implication is that an expansion in credit to private sector would be expected to increase output in the economies resulting in a decline in inflation rate. This finding is in line with Arsene and Guy-Paulin (2013) who established an inverse association of credit to private and inflation in Cameroon. This finding means that if access to credit by the private sector is increased in Burundi, Rwanda, Tanzania and Uganda relative to Kenya, the output in these countries would increase more than Kenya due to diminishing marginal productivity o capital. The increase in output in these countries will reduce the output gap and thus, reduce the variations in inflation rate.

The coefficient of broad money supply variable was 0.4 and was statistically significant at one per cent level of significance. It means that on average, expanding money supply as a percentage of GDP by one percentage point in the EAC is likely to increase the variations of inflation rate by 0.4 percentage points holding all other factors constant. According to the quantity theory of money, money supply affects inflation rate positively through the general price level. A general increase in money supply will cause prices to rise and

consequently cause inflation rate to rise. When money supply grows faster than the growth in real output, it will cause inflation to rise (Doan,2019). This finding supports the results of Simwaka *et al.* (2012), who found a positive effect of money supply on inflation in Malawi for the period 1995-2011. Other studies that have established positive effect of money supply on inflation include Sola and Peter (2013) and Mbongo, Mutasa and Msigwa (2014).

Expansion of aggregate money supply is expected to be associated with increase in the aggregate demand. An expansion in aggregate demand would cause increase in prices if aggregate supply remained unchanged and as such contributing to higher inflation rate. Therefore, the expansion of broad money supply in EAC member countries would increase inflation variability in EAC making the process of forming a monetary union difficult. This is because convergence in inflation is a condition necessary for the unification of currencies.

The coefficient of interest rate variable as a determinant of inflation variability in EAC was found to be -0.056 and statistically significant at ten per cent level of significance. On average, holding all other factors constant, a reduction in interest rate by one percentage point would increase variation of inflation by 0.056 percentage points. This is so because lower interest rate is expected to lead to output expansion through increased investments thereby contributing to a reduction in inflation. Disparities in interest rates among members of a monetary union may lead to differences in inflation given the common monetary policy

(Busetti *et al*., 2007). This implies that if EAC member countries were to enter into a monetary union, the differences in interest rates in these countries should be minimal to ensure convergence of inflation among the member states.

According to the estimation results, the coefficient of government effectiveness variable was negative and statistically significant at five per cent level of significance. The negative association was expected since improvement in government effectiveness is expected to reduce inflation rate variability. From the empirical results, the coefficient was -2.857 meaning that an increase in government effectiveness by one index would reduce inflation variability by 2.857 percentage points. Government effectiveness is a measure of the perception about the quality of policy formulation and implementation and therefore, is an important factor in the quest for EAC member countries to converge in inflation rate for a monetary union. Improvement in the credibility of monetary policies would be essential in moving the specific economies towards the inflation rate target and thus aiding them to converge in this aspect. According to Pétursson (2005), growth variability had declined in general after the adoption of inflation targeting, with the largest gain in emerging market countries in the EU. Honohan and Lane (2003), observed that there was sustained improved inflation performance in the emerging markets which they attributed to increased monetary policy credibility that followed widespread introduction of inflation targeting in EMU. The implication of this finding is that government effectiveness in EAC would be critical in aiding EAC inflation convergence and the catching-up process.

The coefficient of price variable was found to be positive but was statistically insignificant. The sign was as expected since lower price level is likely to be associated with higher inflation according to the classical theory of inflation. Lagoa (2017) found that the coefficient of price level was insignificant in explaining inflation in the Euro area between 1999 and 2008. This was attributed to the possibility of level of price convergence in the euro area which was high enough over the sample period. This means that high price convergence may lead to insignificant effect of price level on inflation convergence a factor that may have led to insignificant price level coefficient in EAC in the study period.

From the results of the study, there is empirical evidence to support convergence of inflation rate among EAC countries. This means that the member states were fulfilling the requirement of the OCA theory with respect to inflation rate. Among the factors driving variations in inflation rate among EAC countries include exchange rate, output gap, bank credit to private sector, broad money supply, interest rate and government effectiveness.

4.4.3 Convergence of Fiscal Variable

The third objective of the study was to examine the state of convergence of fiscal variable in EAC member countries. Fiscal deficit was used in the analysis. The macroeconomic convergence criteria set out by EAC member countries required the countries to achieve a budget deficit of less than five per cent excluding grants and less than two per cent including grants by 2011. To estimate the state of fiscal variable convergence in EAC, equations (3.22) was used. Estimation of equation (3.22) was done using time series data

for the period 1980-2018 where the standard deviation of fiscal deficit among EAC states was regressed against time to show the state of sigma convergence.

Sigma convergence is confirmed if the coefficient of time variable is negative and statistically significant meaning that the variability of fiscal deficit is declining with time. The unit root test for standard deviation of fiscal deficit was done using CMR test of unit root. The CMR unit root test results shown in Table A10 indicate that the variable was stationary at levels. This is because the calculated t-statistic was -5.540 for the IO model which is less than critical value of -5.490 at five per cent level of significance. The null hypothesis of unit root presence was therefore, rejected and the conclusion was that the variable standard deviation of fiscal deficit was stationary at five per cent level of significance. The estimation results of sigma convergence are presented in Table (4.8).

Table 4. 8: Estimation results of sigma convergence in fiscal deficit

Dependent Variable: standard Deviation of Fiscal Deficit			
Explanatory Variables	**Coef.**	**Std. Err.**	**P-Value**
Time (Sigma convergence)	-0.061	0.037	0.116
Dummy	0.688	0.736	0.361
Constant	3.564***	0.903	0.001
Prob > F	0.2825		
R - Squared	0.1188		

Note: ***, denote statistical significance at 1 per cent
Source: Own computation from study data.

The estimation results presented in Table (4.8) shows that the F- test of joint significance

was not statistically significance meaning that the coefficients of the variables included in the model were not jointly significantly different from zero. The R-squared was low meaning that only 11.88 per cent of the variations in fiscal deficit are explained by time variable. From the results of the study, the coefficient of time variable was -0.061 and statistically insignificant. This outcome fails to confirm evidence of sigma convergence of fiscal deficit or lack of thereof among the EAC partner states. The convergence in fiscal deficit is required to ensure fiscal stability. It would bring domestic policies closer and reinforce the monetary integration process. The political diversity in formulation of fiscal policies and the high deviation of fiscal deficit away from the mean in EAC may account for the statistically insignificant results.

To control for effect of country differences on fiscal convergence, equation (3.23) was estimated using panel data. Equation (3.23) was used to analyze the differences in fiscal deficit in EAC countries. In estimating equation (3.23), the deviations of fiscal deficit as the dependent variable was regressed against explanatory variables which included deviations of government debt, inflation, current account, government effectiveness and political instability. The deviations were derived from Kenya as the numeraire country as per the OCA theory.

From the Hausman test of model specification presented in Table A5, the appropriate model identified for the estimation was the random effects model and Table 4.9 summarizes the results.

Table 4. 9: Empirical results for deviations in fiscal deficit

Dependent Variable: Fiscal Deficit Deviations			
Explanatory Variables	**Coefficient**	**Std. Err.**	**P-Value**
Time Variable (Convergence coefficient)	0.206***	0.040	0.000
Debt Divergence	0.016***	0.006	0.011
GDP Divergence	0.126***	0.050	0.012
Inflation Rate Divergence	0.034	0.040	0.392
Current Account Divergence	-0.008	0.042	0.846
Government Effectiveness Divergence	2.072*	1.158	0.073
Political Instability Divergence	0.302	0.304	0.321
Constant	-0.302	0.487	0.535
Wald Chi2 (7) = 37.61	Prob > Chi2 = 0.0000***		
Hausman Test: H_0: Random Effects model is the most appropriate			P- value = 0.2801
R squared		Within	0.3341
		Between	0.9598
		Overall	0.3701

Notes: ***, * denote statistical significance at 1 per cent and 10 per cent, respectively
Source: Own computation from study data.

The random effects regression had a significant p-value of the Wald test which was statistically significant at one per cent level of significance. This means that the variables included in the model were jointly significant in explaining deviations of fiscal deficit in EAC member states. All the variables except current account exhibited the right signs although the coefficients of inflation, current account and political instability were statistically insignificant. The overall R-squared was 0.37 implying that holding all other factors constant, 37 per cent of the variations in fiscal deficit deviations in EAC can be

explained by current debt, GDP growth rate and government effectiveness.

Table 4.9 shows that the coefficient of time which is a measure of deviation in fiscal deficit was 0.206 and statistically significant at one per cent level of significance. The results imply that, all other factors held constant, EAC countries were diverging in fiscal deficit variations and thus ruling out convergence in this variable. The differences in fiscal deficit in EAC were growing over time and thus, EAC countries have been drifting away from converging in fiscal deficit. Fiscal deficit divergence in EAC would be attributed to lack of a surveillance system or institutional framework to enforce fiscal discipline and ensure adherence to the criteria (Kuutesa, 2012). According to the OCA theory, countries envisaging to form a monetary union should converge in terms of budget deficit in order to have an effective monetary policy after the establishment of the monetary union. Similarity of fiscal deficit may lead to synchronization of economic shocks (Tapsoba *et al.*, 2019).

The divergence of fiscal deficit variations implies that each EAC member country need more domestic or foreign debt to ease fiscal deficit. Increasing debts may not be favorable for formation of a monetary union as observed by Neck and Holzmann (2006) who opined that the stability of the EMU was threatened by unfavourable effects of public debt. According to ECA (2018), if many members of a monetary union borrow significantly, this would be an indication of structural problems that could tighten investment in the private sector and possibly damage the long-term stability of the union. Convergence of fiscal

deficit imply convergence of fiscal policies among countries entering in a monetary union. Convergence in fiscal policies is important for the viability of a monetary union, because after adoption of a single monetary policy, national fiscal policy will become the main tool at the disposal of individual countries to respond to national economic shocks (ECA, 2018). The convergence of fiscal deficit would enhance fiscal discipline among member countries. This would be necessary in order to prevent volatile and unstable public finances of one country from negatively affecting other members of the monetary union by putting pressure on the common central bank to monetize public spending (Sembene *et al*., 2018).

The coefficient of debt divergence variable was 0.016 and statistically significant at one per cent level of significance. The positive association between these two variables imply that an increase in public debt deviations as a percentage of GDP contributes positively to the divergence of fiscal deficit in EAC. The results show that a decline in debt divergence by one percentage point would reduce variations in fiscal deficit in EAC by 0.016 percentage points *ceteris paribus*. This finding is in line with Tapsoba *et al*. (2019) who found a positive effect in Africa. Similar results were found by Tujula and Wolswijk, (2004) in OECD countries in the period 1970-2002. According to Tujula and Wolswijk (2004), high debt ratio leads to high interest repayment which worsen the fiscal balance. Decline in debt deviations is an indication of improved economic performance and thus, increased domestic revenues to support the budget. This reduces pressure to finance fiscal deficit through borrowing further reducing fiscal deficit variability.

The coefficient of GDP growth divergence variable was 0.126 and statistically significant at one per cent level of significance. From the study results, a one percentage point increase in GDP divergence can be associated with 0.126 percentage point increase in fiscal deficit divergence in EAC countries. The variable GDP growth deviations is a measure of similarity in the cyclical component of business cycles and the OCA theory asserts that members of a monetary union should exhibit similarity in the cyclical component of business cycles.

The GDP growth in EAC is spurred mostly by infrastructural development which is financed through public debt (ADB, 2019). Therefore, as the economies borrow to finance infrastructure development, there is growth in GDP as well as divergence of the fiscal deficit. This finding confirms the results by Sembene *et.al*., (2018) who established a positive relationship between fiscal deficit and economic growth in Africa between 1990-2015. The similarity of growth rates among countries in a regional bloc could explain convergence of fiscal deficits (Canova, Ciccarelli & Ortega, 2007). According to Barro (1979), countries in a regional economic bloc with divergent growth level may experience divergence in fiscal deficit due to divergent fiscal policies. Therefore, for fiscal deficits of EAC member countries to converge, individual countries need to converge in GDP growth rate of more than seven per cent and adopt similar fiscal policies meant to reduce fiscal deficits.

The study also found the coefficient of government effectiveness divergence variable to be

2.072 and statistically significant at ten per cent level of significance. This implies that the convergence of government effectiveness can be associated with convergence of fiscal deficit in EAC regional economic bloc. The divergence of government effectiveness by one index would lead to fiscal deficit divergence by 2.072 percentage points holding all other factors constant.

The government effectiveness and political stability were used to represent institutional factors that affect convergence of fiscal deficit in the EAC member states. Sembene *et al.* (2018) opined that credible fiscal policies can strengthen fiscal deficit convergence and emphasized on the need of coordinating fiscal policies in member countries of a monetary union. Coordinated policies would ease the task of the common central bank by preventing conflicts of objectives such as high public debt and lower interest rate policy (Besancenot & Vranceanu, 2003).

The coefficient of inflation divergence variable was found to be positive and statistically insignificant. The positive sign implied that a rise in inflation rate divergence would result into an increase in the fiscal deficit divergence within the EAC countries. High inflation rate may result in an increase in long-term interest rates and thus have a negative effect on investment and economic growth (Tujula & Wolswijk, 2004). Reduced investments and GDP growth would hamper growth in tax revenues which may increase fiscal deficit. However, the coefficient of inflation rate divergence variable could have been insignificant because there has not been any substantial variation in inflation rate among the EAC

member countries, a fact which can be attributed to proper managing of inflation rate by the respective Central Banks of the various EAC member countries. This implies that there has been relative price stability among the EAC member countries hence a conducive environment for formation of a monetary union. De Grauwe (1996) obtained similar results in the study on the preparedness of EMU members for a monetary union. The insignificant results were attributed to low differences in inflation rates among the member states prior to joining a monetary union. This is because countries exhibiting less differences in inflation rates are not prone to asymmetric shock because they may still exhibit similar economic structures.

The coefficient of current account divergence variable was found to be negative and statistically insignificant. The negative sign implied that an increase in current account divergence would reduce fiscal deficit divergence in EAC member countries. The twin deficit hypothesis, asserts that there is a positive association between fiscal deficit and current account deficit (Senadza & Aloryito, 2016). As observed by Gebremariam (2018), increased budget deficits in an open economy tend to increase domestic interest rate, which in turn induce capital inflow and consequently cause a real exchange rate appreciation. It is the real appreciation of exchange rate that is attributed to the deterioration of current account balance. However, some studies have also found an inverse relationship between fiscal deficit and current account deficit. Kim and Roubini (2008), for example established that when fiscal accounts diverge, the current account improves and vice versa in the USA. This was attributed to increase in private savings and decline in investment which

contribute to the current account improvement. In addition, the prevalence of output shocks that appear to drive the co-movements of the current account and the fiscal balance would explain the negative association between fiscal deficit and current account deficit in EAC. The EAC member states are net importers, and one way through which they increase their export capacity is to borrow more to invest in increased export production thereby increasing their fiscal deficit. This would account for the positive relationship between current account and fiscal deficit. The similarity in the nature of trade and divergence in fiscal deficits in EAC could account for the insignificant of the coefficient.

The coefficient of political instability divergence variable was found to be 0.302 and statistically insignificant. Political instability was one of the institutional variables that was used in the study to capture the perception of the citizens about the likelihood of political instability and politically motivated violence. The positive sign implies that an increase in the likelihood of political instability divergence in EAC member states would increase fiscal deficit divergence. The positive association could be attributed to deliberate fiscal expansions to gain electoral support by the EAC governments. Since these governments are unable to mobilize sufficient domestic revenues to finance the increased spending, they resort to borrowing thus widening further the fiscal deficit. The coefficient could have been insignificant because of the divergence in political structures and less conflicts between individual countries in EAC. The change in political leadership in some of these countries has taken time with the regime change, on average, happening after a minimum of ten years and in some cases like Uganda, there has been no regime change since 1986. This means

that EAC member states have been politically stable. Tujula and Wolswijk (2004) found that political instability measured by periods of election deteriorated fiscal balances in EMU by about 0.3 per cent between 1970 and 2002. Zyuulu, (2010) also found a positive 0.28 and statistically significant effect of political instability and fiscal deficit in SADC.

Thus, in EAC, fiscal deficit convergence between 2000 and 2018 could not be confirmed. The convergence of fiscal deficit is a core convergence criterion and is key to anchoring fiscal policy in a monetary union as per the OCA theory. Large fiscal deficits could hamper the ability of new monetary authorities to deliver low inflation if deficits are monetized. The lack of convergence in fiscal deficit variable imply that formation of a monetary union may take longer since the fulfilment of the criteria post ante would imply the cost of the monetary union would be higher than the benefits. As observed by Tapsoba *et al*. (2019), creation of a monetary union should be based on compliance with monetary and fiscal convergence programs.

4.4.4 Synchronization of Business Cycles in EAC Countries

The fourth objective of this study was to analyze the synchronization of business cycles in EAC countries. Business cycles synchronization is one of the criteria used to evaluate the desirability of a currency union. When business cycles across economies are synchronized, the cost of using a single currency is reduced since there would be reduced need for asymmetric monetary policy responses to shocks (Cheung & Yuen, 2005). According to Rose (2008), a currency union may thus not be an optimal monetary arrangement

particularly when the economies exhibit asynchronous business cycles.

Four countries in EAC were included in this analysis namely Kenya, Rwanda, Tanzania and Uganda. Burundi was omitted due to unavailability of quarterly data. Quarterly data for the four EAC countries was available from the third quarter of 2008 to the fourth quarter of 2018. Quarterly data was used to increase the number of observations to satisfy the requirements of time series modelling. The sample period was dictated by data availability and the period of economic integration process in EAC.

To undertake this analysis, the Johansen multivariate test of cointegration procedure was used. The procedure is used to test whether variables are cointegrated or have long-run relationship or association. The OCA theory requires the business cycles of countries forming a monetary union to move together or have a long-run relationship. This would ensure effectiveness of monetary policy within the region to address shocks that arise in the respective economies (Cheung & Yuen, 2005). Thus, for the synchronization of business cycles in EAC, the business cycles must be cointegrated or have a long-run relationship meaning that they are synchronized. The business cycles were extracted using the R-studio statistical programme as outlined in section 3.4.3. Once the business cycles were extracted, the Johansen multivariate procedure was employed to analyze the synchronization of business cycles.

In the Johansen multivariate test of cointegration, all variables must be stationary at levels

or if non-stationary at levels, they should become stationary after first difference (Kestel, 2013). This means that all the variables must be integrated of the same order before the Johansen cointegration test is applied. Therefore, before undertaking the Johansen procedure, all the variables were tested for stationarity using Augmented Dickey-Fuller (ADF) unit root test and the results are shown in Table 4.10. The null hypothesis of the test is that variable is nonstationary against the alternative that it is stationary. According to Enders (2015), comparing the test-statistic with the appropriate values reported in the Dickey-Fuller tables allows for the determination whether to accept or reject the null hypothesis. If the test-statistic in absolute values is greater than the critical values, reject the null hypothesis (Enders, 2015).

From the stationarity results shown in Table 4.10, the calculated test-statistic at levels was less than the critical value at conventional significance levels for all the variables for both the intercept and trend and intercept models. As a result, the null hypothesis is not rejected for all the variables for the two models meaning they are found non-stationary at conventional significance levels. The unit root test concludes that all the variables have unit root and hence not stationary at levels. When the variables were differenced once, the calculated test-statistic had values greater than the critical value at conventional significance level and thus the null hypothesis of unit root was rejected making the variables stationary at first difference. The stationarity test confirmed that all the variables were integrated of order one, thus all were candidates for Johansen multivariate cointegration analysis.

Table 4. 10: Unit root test for business cycles in EAC

Variables at levels				
Variable	**With intercept only**		**With trend and intercept**	
	Test- Stat	**P-Value**	**Test- Stat**	**P-Value**
Kenya's Business Cycles	-0.924	0.7696	-2.202	0.4749
Rwanda's Business Cycles	-1.856	0.3481	-2.352	0.3963
Tanzania's Business Cycles	-0.568	0.8662	-1.899	0.6357
Uganda's Business Cycles	-0.594	0.8598	-1.949	0.6084
Variables at First Difference				
	With intercept only		**With trend and intercept**	
	Test- Stat	**P-Value**	**Test- Stat**	**P-Value**
Kenya's Business Cycles	-3.631***	0.0099	-3.648**	0.0395
Rwanda's Business Cycles	-3.562***	0.0123	-3.918**	0.0224
Tanzania's Business Cycles	-5.705***	0.0000	-5.631***	0.0002
Uganda's Business Cycles	-5.337***	0.0001	-5.112***	0.0010

Notes: ***,** denote statistical significance at 1 per cent, and 5 per cent respectively
Critical values -3.621, -2.943, -2.610 for 1 per cent, 5 per cent, and 10 per cent, respectively with intercept only, and
-4.235, -3.540, -3.202 for 1 per cent, 5 per cent, and 10 per cent, respectively with trend and intercept
Source: Author's calculations.

The outcome of the stationarity test paved way for the Johansen multivariate cointegration test. This is because all the business cycles from the four countries were integrated of order one. Cointegrated variables must be integrated of the same order and must become stationary after first difference (Kestel, 2013). The Johansen procedure was employed to examine whether the four business cycles series shared a common stochastic trend or were cointegrated. The Johansen test is based on the trace test and maximum eigen value test

where the guideline to confirm cointegration or not is the trace statistic and the max-eigen statistic (Enders, 2015). When the trace and Maximum eigen value statistic is more than the critical value at five per cent level of significance, the null hypothesis is rejected and the conclusion is that there exists at least one cointegrating vector and thus the variables are cointegrated or have a long run relationship. The results of the Johansen cointegration trace test and max-eigen test are presented in Table 4.11 and Table 4.12 respectively.

Table 4. 11: Johansen cointegration Trace test of business cycles

Trace statistic			
No. Cointegrating Equations	**Trace Statistic**	**0.05 Critical Value**	**p-value**
None	86.50818	63.87610	0.0002*
At most 1	50.97678	42.91525	0.0065*
At most 2	24.54674	25.87211	0.0724
At most 3	8.510018	12.51798	0.2128

Notes: * denotes rejection of the null hypothesis at 0.05 level of significance
H_0: There are at most r cointegrating equations
Source: Own computation from study data.

The null hypothesis for the trace test is that the number of cointegration vectors is $r = r^* < k$, against the alternative that $r = k$. According to the trace statistic shown in Table 4.11, the null hypothesis of no cointegration was rejected in favour of presence of at most two cointegrating equations.

Table 4. 12: Johansen cointegration Maximum Eigenvalue test of business cycles

Maximum Eigen-statistic			
No. Cointegrating Equations	**Max-Eigen Statistic**	**0.05 Critical Value**	**p-value**
None	35.53140	32.11832	0.0183*
At most 1	26.43004	25.82321	0.0416*
At most 2	16.63672	19.38704	0.1437
At most 3	8.510018	12.51798	0.2128

Notes: * denotes rejection of the null hypothesis of no cointegration at 0.05 level of significance
H_0: There are at most r cointegrating equations
Source: Own computation from study data.

The null hypothesis for the maximum eigenvalue test is as for the trace test but the alternative is $r = r^* + 1$. According to the maximum eigen value statistic shown in Table 4.12, the null hypothesis of no cointegration was rejected and the alternative of presence of at most two cointegrating equations is adopted.

The cointegration results suggest that the output gaps or business cycles in EAC member states were cointegrated. The implication is that the stochastic trends that drive the individual output series to wander randomly over time are common to the four East African Community economies (Cheung & Yuen, 2005). The conclusion was therefore, that the business cycles in EAC were cointegrated. This implies that there exists a long run relationship between business cycles in EAC thus confirming similarity of business cycles in the four economies used in the analysis. The cointegration of business cycles may be

viewed as a necessary condition for establishing a currency union in EAC. If the business cycles series are not cointegrated, they drift apart in the long run. If business cycles are not cointegrated, it would be difficult to effectively manage the four economies using a common monetary policy and a common currency. Thus, from the cointegration result, which implies that the business cycles are synchronous in the long run in EAC, is supportive of the concept of a currency union between Kenya, Rwanda, Uganda and Tanzania.

Currency unions have consequences for interactions between its member economies that go beyond bilateral relationships. The cointegration analysis offers a multivariate framework that provides a coherent structure to study both long-run and short-run output interactions (Cheung & Yuen, 2005). According to Cheung and Yuen (2005), the cointegration analysis helps infer whether the output series move together in the long-run, how deviations from the long-run relationships affect short-run output movements and how outputs interact in the short-run. This is important to ensure that a uniform monetary policy across the region is effective in addressing shocks within the region.

Business cycle synchronization is crucial and a practical aspect to consider in formulating policy coordination (Dhueng, 2014). According to Dhueng (2014), a common currency and a common monetary policy can be relatively ineffective in managing economic activities in a currency union if shocks are asymmetric and business cycles are asynchronous. On the other hand, if business cycles are synchronous across economies, asymmetric monetary

policy responses to shocks may not be indispensable, and thus a common monetary policy can be acceptable. From the foregoing analysis, business cycles in EAC tend to move together meaning that they have a long-run relationship and thus, synchronized. This fulfils the requirement of a common monetary union as per the OCA theory.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Introduction

This chapter presents the summary of the study, conclusions, policy implications and areas for further research.

5.2 Summary

The pursuit by EAC member states to form a monetary union aims to maintain monetary and fiscal stability for enhanced economic growth and development of the member countries. It is envisaged that under a monetary union, the respective member countries will be more prosperous, competitive, stable, secure and politically united. For EAC member states to enter into a monetary union, macroeconomic convergence and business cycles synchronization is a requirement. In the quest for monetary unification, the EAC countries put in place macroeconomic convergence criteria as a precondition for monetary unification.

The macroeconomic convergence criteria require convergence of economic growth, monetary variables and fiscal deficit before the countries enter into a monetary union. The OCA theory also requires business cycles of the respective countries to be synchronized before the countries enter into a monetary union. This study analyzed the convergence of the macroeconomic variables and business cycles synchronization towards a monetary

union in EAC. The specific objectives of the study were to: (i) establish the state of growth convergence among EAC member countries; (ii) evaluate the state of convergence of monetary variables in the EAC member countries; (iii) examine the state of convergence of fiscal variable in EAC member countries, and (iv) analyze synchronization of business cycles in EAC countries.

The study employed the Arellano-Bond difference GMM estimation technique to determine the state of growth convergence among EAC member countries by analyzing both absolute and conditional convergence. Gross capital formation, human capital, trade openness, government effectiveness, gross government debt, FDI, ODA, government consumption expenditure, population growth and exchange rate were used as control variables in the analysis of conditional convergence. The empirical findings confirmed existence of both absolute and conditional growth convergence in EAC. This means that the poor countries in EAC were growing at a faster rate and thus, catching-up with the rich countries. With respect to absolute convergence, the study established that the speed of convergence was 0.2 per cent per annum with half-life and full-life of three and 23 years respectively. This means that the EAC member states were converging to a common steady state of economic growth at a low rate of 0.2 per cent per annum and that it would take three years to eliminate half of the growth gaps and 23 years to fully close the growth gaps.

Further, the study established that controlling for the country differences increases the speed of convergence to 0.8 per cent per annum. The increased speed of convergence

reduces the half-life and full-life to one and six years respectively. The factors that increase the speed of convergence and influence the GDP growth convergence were found to be past GDP growth, gross capital formation, human capital, trade openness, government effectiveness, gross government debt, FDI, population growth and exchange rate.

With regard to the convergence of monetary variables in the EAC member states, the study employed a time series model to analyze sigma convergence and a static random effects model to analyze deviation of the monetary variables. Two variables namely exchange rate and inflation rate, were considered in accordance with the macroeconomic convergence criteria adopted by the EAC partner states. From the empirical analysis, the study confirmed that EAC member countries were converging in exchange rate as per the requirements of the macroeconomic convergence criteria and the optimum currency area theory. This means that the variability of exchange rate among EAC member states was declining over the study period. The study further established that asymmetry of business cycles, bilateral trade, economic size and government effectiveness influenced the variability of exchange rate in EAC member countries.

The study found evidence of inflation rate convergence among EAC member countries implying that deviations of inflation rate among the individual member countries was declining with time. This implies that inflation rate among EAC member countries had some similarity as per the requirements of the OCA theory. Inflation rate convergence would ensure that a common monetary policy across the region was optimal in

macroeconomic stabilization. The factors found to influence inflation rate convergence in EAC were exchange rate, output gap, bank credit to private, broad money supply, interest rate and government effectiveness.

To analyze convergence of fiscal variable in EAC, the study employed a time series and panel data analysis to estimate the variability of fiscal deficit. Convergence requires dispersions and variability of fiscal deficit to decline with time. This is important in order to have an effective monetary policy after the establishment of the monetary union. The variables that were found to influence the variability of fiscal deficit included public debt, GDP and government effectiveness. No empirical evidence was found to support fiscal deficit convergence in EAC member states. Rather, the empirical findings showed divergence in fiscal deficit in EAC member countries. This means that the variations in fiscal deficit among EAC member economies were increasing with time. This was attributed to lack of a surveillance system or institutional framework to enforce fiscal discipline and ensure adherence to the convergence criteria.

The convergence of fiscal deficit is a fundamental convergence criterion and is key to anchoring fiscal policy in a monetary union in accordance with the OCA theory. Large fiscal deficits could hamper the effectiveness of a common monetary policy. Due to the lack of fiscal convergence in EAC, the member countries may take longer to enter into a monetary union because the accomplishment of the criteria post *ante* would imply the cost of the monetary union would be higher than the benefits making it not viable.

With regard to business cycles synchronization in EAC member countries, the study employed the Johansen multivariate test of cointegration procedure. The cycles were extracted using the R-studio statistical procedure that decomposed real GDP into four components which included secular trend, cyclical component, seasonal component and irregular component. The secular trend and cyclical components constituted the business cycles. Burundi was not included in the analysis due to lack of data. The study established that the business cycles in EAC were cointegrated implying that there was a long run association of business cycles in the EAC countries. Common business cycles are advantageous in that they reduce the cost of using a single currency thereby reducing the need for asymmetric monetary policy responses to shocks. The cointegration analysis was thus supportive of the concept of a currency union between Kenya, Rwanda, Uganda and Tanzania since the cycles were synchronized as per the OCA theory.

5.3 Conclusions

The results of the study pointed to the fact that EAC member countries were converging with respect to some macroeconomic variables. Apart from fiscal variable, the EAC member countries were converging on other macroeconomic variables such as GDP growth, exchange rate and inflation rate. Business cycles were also synchronous in Rwanda, Kenya, Tanzania and Uganda. This means that EAC member countries are not ready for a monetary union since they are not converging in all the macroeconomic variables. Forming a monetary union in EAC countries may, therefore, take longer since the fulfilment of the criteria post *ante* would imply the cost of the monetary union would

be higher than the benefits. In this respect, future GDP growth endeavors in EAC should focus on gross capital formation, human capital, trade openness, government effectiveness, government debt, FDI, population growth and exchange rate.

Government effectiveness and political stability are important factors influencing the convergence of fiscal and macroeconomic variables. Thus, though there was convergence in macroeconomic variables and divergence in fiscal deficit, the EAC member countries would do much better in their efforts to convergence to a monetary union by 2023 if government effectiveness and political stability was addressed. Further, focusing on the asymmetry of business cycles, bilateral trade, economic size, bank credit to private sector, broad money supply, interest rate, government effectiveness and divergence of debt would enable the EAC member countries to address the convergence of fiscal and monetary variables.

5.4 Policy Implications

The study established existence of both absolute and conditional growth convergence in EAC, implying that the hypothesis of poor countries catching-up with the rich countries is applicable among the EAC partner states. Further, the study found that gross capital formation, human capital, trade openness, government effectiveness, FDI and ODA positively influence growth convergence in EAC. This implies that increase in gross capital formation, human capital, trade openness, FDI, ODA and improved government effectiveness would help EAC countries achieve growth converge at a faster rate. Gross

capital formation was found to have a positive effect on growth convergence in EAC. Gross capital formation affects economic growth through reduction in transportation cost, increased trade, investments and remittances. This makes the economies competitive and more productive thus, aiding them to move closer to the growth target for convergence. Based on this finding, the study therefore, recommends that EAC member states should invest more in physical infrastructure to increase gross capital formation. This can be undertaken by the ministries responsible for infrastructure in collaboration with development partners. Increase in physical infrastructure investments is expected to reduce transportation costs within these countries which in turn would increase trade and attract more investment thereby leading to GDP growth which is important for the convergence of EAC member countries.

The study established that human capital influences economic growth positively in EAC. Influence of human capital on growth is attributed to its effect on productivity and technological absorption. This implies that human capital improves productivity through knowledge that enhances production skills and also through technology absorption and innovation. From this finding, the study recommends that the EAC governments in partnership with non-state actors should increase budgetary allocation to education sector particularly institutions of higher learning. This will ensure skills development for increased productivity and economic growth. Higher productivity growth would also imply increased economic size and thus more benefits of entering the monetary union to the member countries and their citizens.

Exchange rate convergence in EAC member countries is influenced by asymmetry of business cycles, bilateral trade, government effectiveness and economic size. This implies that these factors play an important role in reducing the variability of exchange rate in EAC, which is an important requirement for countries to converge to a monetary union. The study found that the asymmetry of business cycles had a positive effect on exchange rate convergence in EAC countries. This means that a reduction in growth differences among EAC countries would ensure low business cycles and thus, reduce variability in exchange rate in the countries. It is therefore, recommended that EAC governments in partnership with development partners and private sector should increase investments in capital. Increased capital investments in form of roads, rails, sea transport, energy and industries will spur economic growth and due to diminishing marginal product of capital, the countries that are regarded as less developed will grow at a faster rate than the developed ones. This will reduce the growth disparities, reduce asymmetry of business cycles and thus reduce the variability of exchange rate in EAC.

Bilateral trade was found to negatively affect exchange rate variability in EAC. The implication is that deeper trade integration favours formation of a monetary union since it reduces the variability of the exchange rate. It is, therefore, recommended that bilateral trade in EAC should be increased. This can be done through full implementation of the customs union and common markets protocols adopted by the EAC countries. In particular, the EAC governments would achieve this by adopting a common external tariff, complete removal of all non-tariff barriers and harmonize taxes particularly VAT and excise duties.

Adoption of a common external tariff will bring about harmony in the procedure of valuation of goods into the EAC territory. Removal of non-tariff barriers will bring about trade efficiency by reducing the bottle necks that hinder the flow of goods within EAC. Tax harmonization is important since it eliminates tax distortions that hinder efficient allocation of resources within the EAC member states. These measures will bring about increased trade among the EAC countries, which will strengthen the stability and convergence of the exchange rate. Increased trade will reduce the variability of exchange rate and also enhance growth in EAC thus, aiding the EAC countries to convergence in growth and exchange rate.

The study found evidence of inflation rate convergence in EAC member states. According to the study, variability of inflation rate in EAC is influenced by exchange rate, output gap, bank credit to private sector, broad money supply and government effectiveness. The study established that bank credit to private sector had a negative effect on inflation rate convergence. This implies that increased access of credit to the private sector will bring about reduction in the variability of inflation rate in EAC and hence convergence of inflation rate. The study recommends that bank credit to the private sector should be enhanced through expansionary monetary policy. To achieve this, the EAC countries through their respective central banks should reduce the cash reserve requirement that commercial banks are required to maintain so as to make available more credit to the private sector. In addition, lowering the Central bank rate will also increase access to credit by the private sector since it reduces the interest rate. Adoption of these monetary policy

measures will reduce the crowding out of the private sector and facilitate more credit to the private sector thereby reducing the divergence of inflation rates in these countries.

The study did not find any evidence of convergence in fiscal deficit in EAC member countries. The implication is that the EAC member countries were diverging in fiscal deficit due to lack of institutional framework to foster fiscal discipline and ensure compliance to the convergence criteria. This means that each EAC member state pursued its own fiscal policy with no coordination and little adherence to the convergence criteria.

Public debt was found to increase fiscal deficit variations in the EAC countries implying that lowering public debt is vital in enhancing convergence of fiscal deficit. This calls for EAC member states to reduce public debt in order to release more resources away from debt repayment to productive activities. Reducing public debt will require EAC governments to strengthen their revenue generating mechanisms to counter fiscal spending. To achieve this, the EAC governments in consultation with development partners should identify and capitalize on key economic growth drivers for sustained growth thereby enhancing revenue generation. Economic growth drivers that may be targeted include private consumption, gross fixed capital, tourism and FDI. Investment in these factors will spur economic growth which will generate more revenue to meet budgetary requirements.

To enhance fiscal discipline and ensure compliance to the convergence criteria, the EAC member states through the East Africa Legislative Assembly (EALA) and in consultation

with the legislative assemblies in the individual countries should enact laws to empower the EAC secretariat to undertake fiscal coordination and monitor the adherence of specific countries to the convergence criteria. This will ensure that EAC member countries are kept on track in the implementation of the convergence criteria. This is expected to bring about fiscal discipline and enhance convergence and monetary unification in EAC.

The study found that government effectiveness influenced the convergence of growth, monetary and fiscal deficit variables. This implies that the perception by citizens on the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies is an important factor in determining the convergence of the stated variables. Therefore, EAC governments should formulate and implement quality policies so as to improve the citizenry perception. This can be done through building the capacity of the personnel charged with formulation and implementation of policies and programmes on monetary unification.

The study established that business cycles in EAC were synchronized implying existence of long run association of business cycles in the EAC countries. The EAC member states should therefore, harmonize their growth policies so as to ensure that the real GDP growth does not have significant differences among the respective countries that may lead to asynchronous business cycles that are not favourable for monetary unification. To achieve this, the EALA in collaboration with the legislative assemblies in each member country, should put in place a legal framework that provides implementation rules and enforcement

mechanism of decisions of the Monetary Affairs Committee (MAC) on harmonized formulation and implementation of monetary and exchange rate policy in the region.

5.5 Areas for Further Research

The study has employed quantitative econometric techniques to analyze macroeconomic convergence and business cycles synchronization towards a monetary union in the EAC member countries. Though political factors particularly political good will is an important determinant of monetary union formation, the factor was not considered due to difficulties in the measurement of political will. Further, external shocks such as the global financial crisis have ramifications on monetary unification. Thus, further studies could focus on:

i) The effect of political will on macroeconomic convergence towards a monetary union in East African Community member states.

ii) The effect of external shocks on macroeconomic convergence towards a monetary union in East African Community member states.

REFERENCES

African Development Bank (2019). *East African Economic outlook 2019*. African Development Bank

Afonso, A., & Alves, J. (2014). The role of government debt in economic growth. *ISEG-UTL Economics Department Working Paper*, (16).

Agbonkhese, A. O., & Adekola, A. G. (2014). Regional economic integration in developing countries: A case study of Nigeria as a member of ECOWAS. *European Scientific Journal*, *10*(19), 359–374.

Akiba, H. (2007). Monetary Union, Real Exchange Rate, and Welfare. *Journal of Economic Integration*, 22(4), 748-779.

Akpolat, A. G. (2014). The long-term impact of human capital investment on GDP: a panel cointegrated regression analysis. *Economics Research International*, Article ID 646518, 10 pages, doi:10.1155/2014/646518

Alam, M. R., Kiterage, E., & Bizuayehu, B. (2017). Government effectiveness and economic growth. *Economic Bulletin*, *37*(1), 222-227.

Alataş, S., & Çakir, M. (2016). The effect of human capital on economic growth: A panel data analysis. *Yönetim Bilimleri Dergisi*, *14*(27), 539-555.

Almendarez, L. (2013). Human capital theory: Implications for educational development in Belize and the Caribbean. *Caribbean Quarterly*, *59*(3-4), 21-33.

Aman, Q., Ullah, I., & Khan, M. I. (2017). Linkages between exchange rate and economic growth in Pakistan (an econometric approach). *European Journal of Law and Economics*, *44*(1), 157-164.

Amplatz, C. (2003). The economic convergence performance of Central and Eastern European countries. *Economics of Planning*, *36*(4), 273-295.

Anyanwu, J. C. (2014). Factors affecting economic growth in Africa: are there any lessons from China?. *African Development Review*, *26*(3), 468-493.

Arestis, P., Khan, M., & Luintel, K. B. (2002). Fiscal deficits in monetary unions: A comparison of EMU and United States. *Eastern Economic Journal*, *28*(1), 89-103.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The review of economic studies*, *58*(2), 277-297.

Arellano, M. (2003). *Panel data econometrics*. Oxford university press.

Armengol, M. O., MacKay, J., & Pineau, G. (2004). *Regional economic integration in a global framework: G-20 Workshop, 22-23 September 2004*. Frankfurt am Main.

Arsene, M. F., & Guy-Paulin, D. D. (2013). An econometric analysis of the Nexus between credit to the private sector, inflation and economic growth: Case of Cameroon 1965–2010. *Global Journal of Management and Business Research Interdisciplinary*, *13*(7), 41-53.

Ashour, M., & Chen Yong, C. (2018). The impact of exchange rate regimes on economic growth: Empirical study of a set of developing countries during the period 1974–2006. *The Journal of International Trade & Economic Development*, *27*(1), 74-90.

Asongu, S. A. (2014). Are proposed African monetary unions optimal currency areas? Real, monetary and fiscal policy convergence analysis. *African Journal of Economic and Management Studies*, *5*(1), 9–29.

Babu, J. O., Kiprop, S., Kalio, A. M., & Gisore, M. (2015). Effect of domestic debt on economic growth in the east African community. *American Journal of Research Communication*, *3*(9), 73-95.

Bagumhe, E. P. (2013). Feasibility and implication of the East African Community Monetary Union: An Application of Optimal Currency Area Index Methodology. *Paper to be presented at the Fourth International Conference on Development Policy (pp.1-31), National College of Tourism*.

Balogun, E. D. (2007). Monetary policy and economic performance of West African Monetary Zone countries. *MPRA paper No. 4308.*

Baiashvili, T., & Gattini, L. (2020). *Impact of FDI on economic growth: The role of country income levels and institutional strength* (No. 2020/02). EIB Working Papers.

Baltagi, B. (2008). *Econometric analysis of panel data*. John Wiley & Sons, Great Britain

Barrell, R., Gottschalk, S., Holland, D., Khoman, E., Liadze, I., & Pomerantz, O. (2008). *The impact of EMU on growth and employment* (No. 318). Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

Barro, R. J. (1979). On the determination of the public debt. *Journal of political Economy*, *87*(5, Part 1), 940-971.

Barro, R. J., & Sala-i-Martin, X. (1995). *Economic Growth.* New York: McGraw-Hill.

Barro, R. J., & Martin, S. I. X. (2004). *Economic growth* (2nd ed). Cambridge, London: MIT Press

Bayoumi, T., & Eichengreen, B. (1997). Ever closer to heaven? An optimum-currency-area index for European countries. *European economic review*, *41*(3-5), 761-770.

Bayoumi, T., & Eichengreen, B. (1998). Exchange rate volatility and intervention: implications of the theory of optimum currency areas. *Journal of International Economics*, *45*(2), 191-209.

Belke, A., Domnick, C., & Gros, D. (2017). Business cycle synchronization in the EMU: Core vs. periphery. *Open Economies Review*, *28*(5), 863-892.

Benhabib, J., & Spiegel, M. M. (1994). The role of human capital in economic development evidence from aggregate cross-country data. *Journal of Monetary economics*, *34*(2), 143-173.

Bergman, U. M. (1999). Do monetary unions make economic sense? Evidence from the Scandinavian Currency Union, 1873–1913. *Scandinavian Journal of Economics*, *101*(3), 363-377.

Bernard, A. B., & Durlauf, S. N. (1995). Convergence in international output. *Journal of applied econometrics*, *10*(2), 97-108.

Besancenot, D., & Vranceanu, R. (2003). Credibility costs in the monetary integration game. *Economics of Transition*, *11*(4), 727-741.

Birdsall, N., Kelley, A. C., Sinding, S. W., & Sinding, S. (2001). *Population matters: demographic change, economic growth, and poverty in the developing world*. Oxford University Press.

Bitzenis, A, & Andronikidis, A. (2006). Cost and Benefits of Integration in the European Union and in the Economic Monetary Union (EMU). *Economics, Management, and Financial Markets Journal*, *1*(2), 7-53.

Blundell, R., Bond, S., & Windmeijer, F. (2000). *Estimation in dynamic panel data models:*

improving on the performance of the standard GMM estimator (IFS Working Papers W00/12). Institute for Fiscal Studies: London, UK.

Botto Tornielli, S. (2018). Convergence Towards an Optimal Currency Area in the European Union. *Harvey M. Applebaum '59 Award*. 16

Broz, T. (2005). Optimum Currency Areas: A Literature Review. *Privredna kretanja i ekonomska politika*, *104*, 53-78.

Brož, V., & Kočenda, E. (2018). Dynamics and factors of inflation convergence in the European union. *Journal of International Money and Finance*, *86*, 93-111.

Buigut, S. (2011). A fast-track East African Community Monetary Union? Convergence evidence from a cointegration analysis. *International Journal of Economics and Finance*, *3*(1), 255-261.

Buigut, S. K., & Valev, N. T. (2005). Is the proposed East African monetary union an optimal currency area? A structural vector autoregression analysis. *World Development*, *33*(12), 2119-2133.

Burhanudin, M. D. A., Muda, R., Nathan, S. B. S., & Arshad, R. (2017). Real effects of government debt on sustainable economic growth in Malaysia. *Journal of International Studies, 10*(3), 161-172.

Busetti, F., Forni, L., Harvey, A., & Venditti, F. (2007). Inflation Convergence and Divergence within the European Monetary Union," *International Journal of Central Banking*, 3, 95– 121.

Cameron, R., Côté, D., & Graham, C. (2005). *Economic integration in Europe: its effects on Canada*. Working Paper Bank of Canada.

Canova, F., Ciccarelli, M., & Ortega, E. (2007). Similarities and convergence in G-7 cycles. *Journal of Monetary Economics*, *54*(3), 850-878.

Checherita-Westphal, C. D., & Rother, P. (2012). The impact of high and growing government debt on economic growth: an empirical investigation for the euro area. *European economic review*, *56*(7), 1392-1405.

Cheung, Y. W., & Yuen, J. (2005). The suitability of a greater China currency union. *Pacific Economic Review*, *10*(1), 83-103.

Clemente, J., Montañés, A., & Reyes, M. (1998). Testing for a unit root in variables with a double change in the mean. *Economics letters*, *59*(2), 175-182.

Cortright, J. C. (2001). New growth theory, new growth theory, technology and learning: Technology and learning: A practitioner's guide a practitioner's guide. *Reviews of economic development literature and practice*, *1*(4), pp.1-40.

Dagum, E. B., & Bianconcini, S. (2016). *Seasonal adjustment methods and real time trend-cycle estimation*. Springer International Publishing.

Dao, M. Q. (2012). Population and economic growth in developing countries. *International Journal of Academic Research in Business and Social Sciences*, *2*(1), 6.

Davoodi, H. R. (Ed.). (2012). *The East African Community After Ten Years: Deepening Integration*. East African Community.

Debrun, M. X., Pattillo, M. C. A., & Masson, M. P. R. (2011). *Should African monetary unions be expanded? An empirical investigation of the scope for monetary integration in Sub-Saharan Africa* (No. 10-157). International Monetary Fund.

De Grauwe, P. (1996). The economics of convergence: Towards monetary union in Europe. *Weltwirtschaftliches Archiv*, *132*(1), 1-27.

De Grauwe, P., & Heens, H. (1993). Real exchange rate variability in monetary unions. *Recherches Économiques de Louvain/Louvain Economic Review*, *59*(1-2), 105-117.

De Grauwe, P., & Ji, Y. (2017). The international synchronization of business cycles: the role of animal spirits. *Open Economies Review*, *28*(3), 383-412.

De Grauwe, P. (2018). *Economics of monetary union*. USA: Oxford university press.

Dellas, H., & Tavlas, G. S. (2009). An optimum-currency-area odyssey. *Journal of International Money and Finance*, *28*(7), 1117-1137.

Dell'Ariccia, G. (1999). Exchange rate fluctuations and trade flows: Evidence from the European Union. *IMF Staff papers*, *46*(3), 315-334.

Devarajan, S., Swaroop, V., & Zou, H. F. (1996). The composition of public expenditure and economic growth. *Journal of Monetary Economics*, *37*(2), 313-344.

Dhungel, K. R. (2014). Estimation of short and long run equilibrium coefficients in error correction model: an empirical evidence from Nepal. *International Journal of Econometrics and Financial Management*, *2*(6), 214-219.

Ding, S., & Knight, J. (2011). Why has China grown so fast? The role of physical and human capital formation. *Oxford Bulletin of Economics and Statistics*, *73*(2), 141-174.

Dinh, T. T. H., Vo, D. H., & Nguyen, T. C. (2019). Foreign Direct Investment and Economic Growth in the Short Run and Long Run: Empirical Evidence from Developing Countries. *Journal of Risk and Financial Management*, *12*(4), 176.

Doan Van, D. (2019), "Money supply and inflation impact on economic growth", *Journal of Financial Economic Policy*, Vol. 12 No. 1, pp. 121-136. https://doi.org/10.1108/JFEP-10-2018-0152

Dramani, L. A. (2010). *Convergence and economic integration in Africa: The Case of the Franc zone countries.* Kenya: The African Economic Research Consortium

Drummond, M. P., Aisen, M. A., Alper, M. C. E., Fuli, M. E., & Walker, M. S. (2015). *Toward a monetary union in the East African Community: asymmetric shocks, exchange rates, and risk-sharing mechanisms* (No. 15-16). International Monetary Fund.

Duarte, M., Restuccia, D., & Waddle, A. (2007). Exchange rates and business cycles across countries. *FRB Richmond Economic Quarterly*, *93*(1), 57-76.

Durevall, D. (2011). *East African community: pre-conditions for an effective monetary union*. Working Papers in Economics 520

Economic Commission for Africa. (2006). *Assessing regional integration in Africa II rationalizing regional economic.* Addis Ababa (Ethiopia): UNECA.

Economic Commission for Africa. (2010). *Assessing regional integration in Africa IV, Enhancing intra-African trade*. Addis Ababa (Ethiopia): UNECA.

Economic Commission for Africa. (2012). *Towards a Common Currency in the East African Community Issues, Challenges and Prospects*. Kigali: UNECA.

Economic Commission for Africa. (2015). *Economic report on Africa 2015: Industrializing through trade*. Addis Ababa, Ethiopia: UNECA.

Economic Commission for Africa. (2018). *The East African Monetary Union: Ready or not?* Kigali, Rwanda: UNECA.

Ek, A. (2007). The Impact of FDI on Economic Growth: The Case of China (Dissertation). Retrieved from http://urn.kb.se/resolve?urn=urn:nbn:se:hj:diva-1038

Ekanayake, E. M., & Chatrna, D. (2010). The effect of foreign aid on economic growth in developing countries. *Journal of International Business and cultural studies*, 3(1), 1–13.

Enders, W. (2015). Applied econometric time series (4th ed.). Hoboken, NJ: Wiley.

Enoch, C., & Krueger, R. (2010). Currency unions: key variables, definitions, measurement, and statistical improvement. *CH-4002 Basel, Switzerland*, 139.

Eyster, G. (2014). *Economic Development and Regional Integration in the East African Community*. Indiana University: Policy Analysis.

Fischer, B. (1998). *Globalization and the competitiveness of regional blocks in comparative perspective* (No. 50). HWWA Discussion Paper.

Frankel, J. A., & Rose, A. K. (1998). The endogeneity of the optimum currency area criteria. *The Economic Journal*, *108*(449), 1009-1025.

Franks, J., B. Barkbu, R. Blavy, W. Oman, and H. Schoelermann. 2018. "Economic Convergence in the Euro Area: Coming Together or Drifting Apart?" IMF Working Paper No. 18/10 (January).

Franks, M. J. R., Barkbu, M. B. B., Blavy, M. R., Oman, W., & Schoelermann, H. (2018). *Economic Convergence in the Euro Area: Coming Together or Drifting Apart?* IMF Working Paper No. 18/10 (January).

Fratianni, M. (2006). *Regional economic integration*. Amsterdam: Elsevier JAI. *Harmonizing policies to transform the trading environment: assessing regional integration in Africa IV*. (2013). Addis Ababa: Economic Commission for Africa.

Gebremariam, T. K. (2018). The Effect of Budget Deficit on Current Account Deficit in Ethiopia: Investigating the Twin-Deficit Hypothesis. *International Journal of Economic and Management Science*, *7*(4), 1-6.

Geda, A., & Kebret, H. (2008). Regional economic integration in Africa: A review of problems and prospects with a case study of COMESA. *Journal of African Economies*, *17*(3), 357-394.

Ghosh, S., & Gregoriou, A. (2006). *On the composition of government spending, optimal fiscal policy, and endogenous growth: Theory and evidence*. Brunel University Discussion Paper No. 06-19.

Girma, H. (2015). The impact of foreign aid on economic growth: Empirical evidence from Ethiopia (1974-2011) using ARDL approach. *Journal of Research in Economics and International Finance (JREIF)*, *4*(1), 1-12.

Githuku, S., Omolo, J., & Mwabu, G. (2018). Income convergence in the east African community. *African Journal of Economic Review*, *6*(1), 87-102.

Gómez-Puig, M., & Sosvilla-Rivero, S. (2018). Public debt and economic growth: Further evidence for the Euro area. *Acta Oeconomica*, *68*(2), 209-229.

Gong, L., & Zou, H. F. (2001). Foreign aid reduces labor supply and capital accumulation. *Review of Development Economics*, *5*(1), 105-118.

Grier, K. B., & Smallwood, A. D. (2007). Uncertainty and export performance: Evidence from 18 countries. *Journal of Money, Credit and Banking*, *39*(4), 965-979.

Gujarati, D. N. (2009). *Basic econometrics*. Tata McGraw-Hill Education.

Gumus, I., & Taşpınar, Z. T. (2015). Real exchange rate volatility and business cycles in emerging market economies. *Economics Letters*, *134*, 127-129.

Hammouda, H. B., Karingi, S. N., Njuguna, A. E., & Jallab, M. S. (2007). Does Macroeconomic Convergence Lead to Growth? The Case of Africa. In *African Economic Conference (AEC), AfDB Group, Tunisia. Available at: https://www. afdb.org/fileadmin/uploads/afdb/Documents/Knowledge/Conference_2007_angla is _17-part-IV-1. pdf (accessed 11 September 2020).*

Hammouda, H. B., Karingi, S. N., Njuguna, A. E., & Jallab, M. S. (2009). Why doesn't regional integration improve income convergence in Africa? *African Development Review*, *21*(2), 291-330.

Hartzenberg, T. (2011). Regional integration in Africa. *Available at SSRN 1941742*.

Headey, D. D., & Hodge, A. (2009). The effect of population growth on economic growth: A meta-regression analysis of the macroeconomic literature. *Population and Development Review*, *35*(2), 221-248.

Hill, H. and J. Menon (2014), '*ASEAN Commercial Policy: A Rare Case of Outward-Looking Regional Integration*'. ADB Working Paper Series on Regional Economic Integration, No. 144. https://www.adb.org/sites/default/files/publica

tion/150385/reiwp-144.pdf.

Honohan, P., & Lane, P. R. (2003). Divergent inflation rates in EMU. *Economic Policy*, *18*(37), 357-394.

Horvath, R., & Koprnicka, K. (2008). *Inflation Differentials in EU New Member States: An Empirical Evidence*. William Davidson Institute working Paper No. 937.

Islam, N. (1995). Growth empirics: a panel data approach. *The Quarterly Journal of Economics*, *110*(4), 1127-1170.

Izushi, H., & Huggins, R. (2004). *Empirical analysis of human capital development and economic growth in European regions*. Third Report on Vocational Training Research in Europe, Series, (54).

Jiboku, P. A., & Okeke-Uzodike, U. (2016). Regional Economic Integration and the Governance Challenge in Africa: Missing Links in the African Peer Review Mechanism. *Africa Development*, *41*(2), 47-70.

Jonung, L., & Sjöholm, F. (1999). Should Finland and Sweden form a monetary union? *World Economy*, *22*(5), 683-700.

Kaboro, J., Kalio, A., & Kibet, L. (2018). The effect of real gross domestic product (GDP) growth rate convergence on exchange rate volatility in search for the East African monetary union. *Journal of Economics and International Finance*, *10*(6), 65-76.

Kappel, S. (2015). A Comparison of Business Cycles Synchronization in the Euro Area and Some Potential Monetary Unions. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, *63*(4), 1277-1285.

Karanasos, M., Koutroumpis, P., Karavias, Y., Kartsaklas, A., & Arakelian, V. (2016).

Inflation convergence in the EMU. *Journal of Empirical Finance*, *39*, 241-253.

Karras, G. (2001). Openness to trade and the potency of monetary policy: How strong is the relationship? *Open economies review*, *12*(1), 61-73.

Kartal, Z., Zhumasheva, A., & Acaroglu, H. (2017). *The Effect of Human Capital on Economic Growth: A Time Series Analysis for Turkey*. In Regional Studies on Economic Growth, Financial Economics and Management (pp. 175-191). Springer, Cham. https://doi.org/10.1007/978-3-319-54112-9_11.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2011). The worldwide governance indicators: methodology and analytical issues. *Hague Journal on the Rule of Law*, *3*(2), 220-246.

Kedir, A. M. (2017). *Drivers of Economic Growth in Africa: Opportunities, Financing and Capacity Issues.* The African Capacity Building Foundation, Harare, Zimbabwe.

Kendall, P. (2000). Exchange rate convergence in CARICOM. *Social and Economic Studies*, 139-166.

Kenen, P. (1969). The theory of optimum currency areas: an eclectic view. *Monetary problems of the international economy*, *45*(3), 41-60.

Kenen, P.B. (2010). There was no analytical alternative to the theory of optimum currency areas. *Econ Journal Watch, 7(1), 73-75.*

Kestel, S. (2013). Vector autoregressive-VAR Models and Cointegration Analysis. https://doi=10.1.1.379.3191&rep=rep1&type=pdf

Kim, S., & Roubini, N. (2008). Twin deficit or twin divergence? Fiscal policy, current account, and real exchange rate in the US. *Journal of international*

Economics, *74*(2), 362-383.

Klasen, S., & Lawson, D. (2007). *The impact of population growth on economic growth and poverty reduction in Uganda* (No. 133). Diskussionsbeiträge.

Knobel, A., & Mironov, A. (2015). Assessment of CIS countries readiness for creation of currency union. *Journal of the New Economic Association*, *25*(1), 76-101.

Kočenda, E., & Papell, D. H. (1997). Inflation convergence within the European Union: A panel data analysis. *International Journal of Finance & Economics*, *2*(3), 189-198.

Kovacic, Z., & Vilotic, M. (2017). *Assessing European business cycles synchronization*. MPRA Paper no. 79990, Munich University, Germany.

Krugman, P. (1993). *What do we need to know about the international monetary system?* (No. 190). International Economics Section, Department of Economics Princeton University.

Kuteesa, A. (2012). East African regional integration: challenges in meeting the convergence criteria for monetary union: a survey. *International Journal of Economics and Finance*, *4*(10), 147.

Lagoa, S. (2017). Determinants of inflation differentials in the euro area: Is the New Keynesian Phillips Curve enough? *Journal of applied economics*, *20*(1), 75-103.

Landau, D. (1986). Government and economic growth in the less developed countries: an empirical study for 1960-1980. *Economic Development and Cultural Change*, *35*(1), 35-75.

Lucas Jr, R. E. (1988). On the mechanics of economic development. *Journal of monetary*

economics, *22*(1), 3-42.

Mafusire, A., & Brixiova, Z. (2012). Macroeconomic shock synchronization in the East African community. *Global Economy Journal*, *13*(2), 261-280.

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The quarterly journal of economics*, *107*(2), 407-437.

Mapuva, J. W. M. (2014). The SADC regional bloc: What challenges and prospects for regional integration? *Law, Democracy & Development*, *18*(1), 22-36.

Matchaya, G., Nhemachena, C., & Nhlengenthwa, S. (2018). Income growth, population and savings in the Southern Africa Development Community region. *South African Journal of Economic and Management Sciences*, *21*(1), 1-9.

Mathur, S. K. (2005). Economic growth & conditional convergence: Its speed for selected regions for 1961-2001. *Indian Economic Review*, 185-208.

Masinde, W., & Omolo, C. O. (2017). The Road to East African Integration. *East African Community Law: Institutional, Substantive and Comparative EU Aspects*, 1-21.

Mbongo, J. E., Mutasa, F., & Msigwa, R. E. (2014). The effects of money supply on inflation in Tanzania. *Economics*, *3*(2), 19-26.

McKinnon, R. I. (1963). Optimum currency areas. *The American economic review*, *53*(4), 717-725.

Melnyk, L., Kubatko, O., & Pysarenko, S. (2014). The impact of foreign direct investment on economic growth: case of post communism transition economies. *Problems and perspectives in Management*, (12, Iss. 1), 17-24.

Mishra, S. (2016). Endogenous Growth Theory and Role of Education. *Splint International*

Journal of Professionals, *3*(10), 74-78.

Mkenda, B.K. (2001), "*Is EA an optimum currency area?*", Working Papers in Economics, No. 41, School of Economics and Commercial Law, Goteborg University, Goteborg.

Mongelli, F. P. (2008). *European economic and monetary integration, and the optimum currency area theory* (No. 302). Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

Mose, N., & Kaboro, J. (2019). Does Inflation Rate Convergence Spur Exchange Rate Volatility? Empirical Evidence from Sub-Saharan Africa. *Asian Journal of Economic Modeling*, *7*(2), 95-109.

Mundell, R. A. (1961). A theory of optimum currency areas. *The American economic review*, *51*(4), 657-665.

Mwasha, O. N. (2011). The benefits of regional economic integration for developing countries in Africa: A case of East African Community (EAC). *Korea Review of International Studies*, *1*(8), 69-92.

Nakibullah, A. (2017). State of Shocks Synchronization among Members of the GCC. *Research in World Economy*, *8*(1), 15-23.

Neck, R., & Holzmann, R. (2006). Fiscal policy and public debt sustainability in the EMU. *Empirica*, *33*(2-3), 61-62.

Nello, S. S. (2009). *The European Union: economics, policies and history*. New York: McGraw-Hill

Njuguna, A.E. (1999). *Growth and convergence in a disequilibrium Solow-Swan model*: The case of ASEAN (PhD thesis). University of New England, New South Wales, Australia.

Nnanna, O. J. (2006, September). Economic and monetary integration in Africa. In *G24 meeting in Singapore, on September* (Vol. 14, p. 2006).

Nugent, N. (2017). *The government and politics of the European Union*. London: Palgrave.

O'brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & quantity*, *41*(5), 673-690.

Oloruntoba, S. O. (2016). Globalization and Regional Trade Agreements. In *Regionalism and Integration in Africa* (pp. 19-37). New York: Palgrave Macmillan.

Ombeni, N. (2011). The Benefits of Regional Economic Integration for Developing Countries in Africa: A Case of East African Community. *Korea Review of International Studies*, *1*(8), 69-92.

Ongo, E. N., & Vukenkeng, A. W. (2014). Does gross capital formation matter for economic growth in the CEMAC sub-region? *EuroEconomica*, *33*(2), 79–88.

Ouma, D., Kimani, T., & Manyasa, E. (2016). Agricultural trade and economic growth in East African Community. *African Journal of Economic Review*, *4*(2), 203-221.

Panizza, U., & Presbitero, A. F. (2013). *Public debt and economic growth, one more time*. VoxEU. org, available at: http://www.voxeu.org/article/public-debt-and-economic-growth-one-more-time.

Papiashvili, T. (2009). The Political Economy of Monetary Integration in Transition Countries. *IBSU Scientific Journal*, *3*(1), 5-20.

Pelinescu, E. (2015). The impact of human capital on economic growth. *Procedia Economics and Finance*, *22*(1), 184-190.

Péridy, N., Hazem, M., & Brunetto, M. (2013). Some new insights into real convergence in MENA countries-regional areas: a spatial econometric analysis. *Economics and Business Letters*, *2*(4), 150-160.

Peter, A., & Bakari, I. (2018). Impact of Population Growth on Economic Growth in Africa: A Dynamic Panel Data Approach (1980-2015). *Pakistan Journal of Humanities and Social Science (PJHSS)*, *6*(4), 412-427.

Peterson, E. W. F. (2017). The Role of Population in Economic Growth. *SAGE Open*. October 2017. doi:10.1177/2158244017736094

Pétursson, T. G. (2005). *Inflation targeting and its effects on macroeconomic performance* (No. 2005/5). SUERF Studies.

Phillips, P. C., & Xiao, Z. (1998). A primer on unit root testing. *Journal of Economic Surveys*, *12*(5), 423-470.

Phiri, M. W. (2017). The Impact of Aid on the Economic Growth of Developing Countries (LDCs) in Sub-Saharan Africa. *Gettysburg Economic Review*, *10*(4), 20–48.

Porrata-Doria R A (2004) MERCOSUR: The Common Market of the Twenty-First Century? Ga. J. Int'l & Comp. L. 32(1) 1–72

Pritchett, L. (2001). Where has all the education gone? *World Bank Economic Review*, 15(3), 367–391.

Pütün, M. (2014). The Theories of Optimum Currency Area: A Critical Review. *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *23*(1), 177-192.

Rahman, A. (2015). Impact of foreign direct investment on economic growth: Empirical evidence from Bangladesh. *International Journal of Economics and Finance, 7*(2), 178-185.

Ramos, R., Suriñach, J., & Artís, M. (2010). Human capital spillovers, productivity and regional convergence in Spain. *Papers in Regional Science, 89*(2), 435-447.

Ramos, R., Surinach, J., & Artís, M. (2012). Regional economic growth and human capital: the role of over-education. *Regional Studies, 46*(10), 1389-1400.

Republic of Kenya (2018). Ministry of East African Community and Regional Development strategic plan (2018-2022).

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of political economy*, *94*(5), 1002-1037.

Romer, P. M. (1990). Endogenous technological change. *Journal of political Economy*, *98*(5, Part 2), S71-S102.

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *The stata journal*, *9*(1), 86-136.

Rose, A. K. (2008). *Is EMU becoming an optimum currency area? The evidence on trade and business cycle synchronization*. University of California, Berkeley working paper, mimeo.

Roe, T., & Diao, X. (2004). Capital accumulation and economic growth: The case of the retail food industry in developing countries. *American Journal of Agricultural Economics*, *86*(3), 788-794.

Sachs, J. (2008). *Common wealth: Economics for a crowded planet*. New York: Penguin

press.

Sachs, J. D., & Warner, A. M. (1997). Fundamental sources of long-run growth. *The American economic review*, *87*(2), 184-188.

Schaffar, A., & Péridy, N. (2015). Exploring spatial convergence of Maghreb regional areas: An application of a Markov chains approach. *Economics Bulletin*, *35*(3), 1848-1855.

Seid, E. H. (2013). *Regional integration and trade in Africa: Augmented gravity model approach*. Addis Ababa, Ethiopia: The Horn Economic and Social Policy Institute (HESPI).

Sembene, D., Gammadigbe, V., Issifou, I., & Sampawende, J. A. T. (2018). Fiscal Convergence in Africa: What Role for Regional Economic Communities? *Journal of Economic Integration, 34*(2), 214-235.

Senadza, B., & Aloryito, G. (2016). The twin deficits hypothesis: Evidence from Ghana. *International Journal of Business and Economic Sciences Applied Research*, *9*(3), 55-62.

Sheikh, K. A., Azam, M. N., Rabby, T. G., Alam, G. M., & Khan, I. (2011). Monetary union for the development process in the East African community: Business cycle synchronization approach. *African Journal of Business Management, 5*(17), 7632-7641.

Shkolnyk, I., & Koilo, V. (2018). The relationship between external debt and economic growth: Empirical evidence from Ukraine and other emerging economies. *Investment Management and Financial Innovations*, *15*(1), 387–400.

Siddique, H. M. A., Ansar, R., Naeem, M. M., & Yaqoob, S. (2017). Impact of FDI on economic growth: Evidence from Pakistan. *Bulletin of Business and Economics*, *6*(3), 111-116.

Simwaka, K., Ligoya, P., Kabango, G., & Chikonda, M. (2012). Money supply and inflation in Malawi: An econometric investigation. *Journal of Economics and International Finance*, *4*(2), 36-48.

Singh, R. J., Haacker, M., Lee, K. W., & Le Goff, M. (2011). Determinants and macroeconomic impact of remittances in Sub-Saharan Africa. *Journal of African Economies*, *20*(2), 312-340.

Sjöberg, P. (2003). Government expenditures effect on economic growth: the case of Sweden 1960-2001 (Dissertation). Retrieved from http://urn.kb.se/resolve?urn=urn:nbn:se:ltu:diva-48709

Sola, O., & Peter, A. (2013). Money supply and inflation in Nigeria: Implications for national development. *Modern Economy*, 4, 161-170.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The quarterly journal of economics*, *70*(1), 65-94.

Spilioti, S. (2015). The relationship between the government debt and GDP growth: evidence of the Euro area countries. *Investment Management and Financial Innovations*, *12*(1), 174-178.

Szeles, M. R., & Marinescu, N. (2010). Real convergence in the CEECs, euro area accession and the role of Romania. *The European Journal of Comparative Economics*, *7*(1), 181-202, ISSN 1722–4667

Tavlas, G.S (1993). The theory of optimum currency areas revisited. *Finance and Development*, *30*(2), 32-35.

Tavlas, G. S. (1994). The theory of monetary integration. *Open economies review*, *5*(2), 211-230.

Tapsoba, S. J. A., Sembene, D., GAMMADIGBE, V., & Issifou, I. (2019). Fiscal convergence in africa. *Journal of Economic Integration*, *34*(2), 214-235.

Tenreyro, S. (2007). On the trade impact of nominal exchange rate volatility. *Journal of Development Economics*, *82*(2), 485-508.

Tjirongo, M. T. (1995). *Short-term stabilization versus long-term price stability: evaluating Namibia's membership of the Common Monetary Area*. Oxford: University of Oxford.

Tokarski, P. (2019). Divergence and Diversity in the Euro Area: The Case of Germany, France and Italy. *German Institute for International and Security Affairs*, 7(27). doi: 10.18449/2019RP06

Tomić, D., & Demanuele, D. (2017). Synchronicity and Similarity of Business Cycles; Croatia vis à vis New EMU Countries. *Review of Innovation and Competitiveness: A Journal of Economic and Social Research*, *3*(4), 31-56.

Toulaboe, D., Terry, R., & Johansen, T. (2009). Foreign direct investment and economic growth in developing countries. *Southwestern Economic Review*, *36*, 155-169.

Tower, E. and T. D. Willett (1976), *The Theory of Optimum Currency Areas and Exchange Rate Flexibility*, (Essay in International Finance, no. 11) (Princeton, N. J.: Princeton University Press).

Tujula, M., & Wolswijk, G. (2004). What determines fiscal balances? An empirical investigation in determinants of changes in OECD budget balances. ECB Working Paper, No. 422. *Available at SSRN: https://ssrn.com/abstract=631669*

Umeora, C. (2013). Effects of foreign direct investment (FDI) on economic growth in Nigeria. SSRN Working Papers (June 26, 2013), *Available at* http://dx.doi.org/10.2139/ssrn.2285329.

Ventosa-Santaulària, D. (2009). Spurious regression. *Journal of Probability and Statistics*, vol. 2009, 2009: 1–27. https://doi.org/10.1155/2009/802975.

Waffubwa, I. (2014). *Towards political federation in the East African Community: achievements and challenges*. Arusha: East African community.

Wagner, H. (2001). Preconditions for the Success of the European Monetary Union. In *the Making of the European Union* (pp. 43-65). Springer, Berlin, Heidelberg.

Wagner H. (2001). Preconditions for the Success of the European Monetary Union. In: Haller M. (eds) The Making of the European Union. European and Transatlantic Studies. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-59443-4_3

Wahab, M. (2011). Asymmetric output growth effects of government spending: Cross-sectional and panel data evidence. *International Review of Economics & Finance*, *20*(4), 574-590.

World Bank. (2016). *Worldwide governance indicators*. World Bank.

Wyplosz, C. (1997). EMU: Why and how it might happen. *Journal of Economic Perspectives*, *11*(4), 3-21.

Yiew, T. H., & Lau, E. (2018). Does foreign aid contribute to or impeded economic growth?. *Journal of International Studies, 2*(3), 21-30.

Zahrnt, V. (2005). How regionalization can be a pillar of a more effective World Trade Organization. *Journal of World Trade, 39(4),* 671-699.

Zentralbank, E. (2015). Real convergence in the euro area: evidence, theory and policy implications. *ECB Economic Bulletin,* (5), 30-45.

Zyuulu, I. (2010). "Convergence in the SADC and African economic integration process: prospects and statistical issues," IFC Bulletins chapters, in: Bank for International Settlements (ed.), Proceedings of the SARB/IFC seminar on "Economic and financial convergence en route to regional economic integration: experience, prospects and statistics, volume 32, pages 96-105, Bank for International Settlements. <https://ideas.repec.org/h/bis/bisifc/32-06.html>

APPENDIX A: NEOCLASSICAL GROWTH MODEL

According to Solow's (1956) neo-classical growth theory, the production function is used to measure the growth and equilibrium of an economy. The production function can be expressed as:

$$Y_t = f(A_t, K_t, L_t) \quad \ldots\ldots (3.1)$$

Where where Y, A, K and L are output, the level of technology, the stock of physical capital and labour force at time t, respectively. Because of the relationship between labour and technology, the economy's production function can be re-written as:

$$Y_t = f(K_t, A_t L_t) \quad \ldots\ldots (3.2)$$

Equation 3.2 may be expressed in terms of output per effective labour as:

$$y_t = f(k_t) \quad \ldots\ldots (3.3)$$

Where $k_t = \frac{K_t}{A_t L_t}$ and $y_t = \frac{Y_t}{A_t L_t}$

This implies that the growth rate of output is dependent on the growth in labour, capital and technological progress. In the Solow (1956) model, the growth of labour is assumed to be at a constant rate (n) so that

$$\dot{L} = L_0 e^{nt} \quad \ldots\ldots (3.4)$$

$$n \geq 0 \quad \ldots\ldots (3.5)$$

$$\frac{\dot{L}}{L} = n \quad \ldots\ldots (3.6)$$

The other source of growth in this model is physical capital accumulation. This occurs through investment expenditures (I). The theory assumes that all savings are invested and that savings are a constant proportion (s) of output such that:

$$S_t = sY_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.7)$$

$$0 \leq s \leq 1 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.8)$$

Where s is the propensity to save.

With these assumptions, the net increase in the stock of physical capital can be expressed as:

$$\dot{K}_t = I_t - \delta K_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.9)$$

Given the assumption that investment is equal to savings (I=S), equation 3.8 can be plugged into equation 3.9 to get:

$$\dot{K}_t = sY_t - \delta K_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.10)$$

Incorporating equation 3.2 into equation 3.10 yields:

$$\dot{K}_t = sf(K_t, A_tL_t) - \delta K_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.11)$$

Because of the assumption of constant returns to scale, both variables in brackets of equation 3.11 can be divided by A(t)L(t) provided the function (f) is multiplied by the same factor so that:

$$\dot{K}_t = sA_tL_tf\left(\frac{K_t}{A_tL_t}, 1\right) - \delta K_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.12)$$

Equation 3.12 can be written as:

$$\dot{K}_t = sA_tL_tf(k_t) - \delta K_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.13)$$

Dividing equation (3.13) by AL yields:

$$\frac{\dot{K}_t}{A_tL_t} = sf(k_t) - \delta k_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.14)$$

The steady-state equilibrium is analysed by deriving the expression for the evolution of

capital per worker over time. Omiting technological change, and since:

$\frac{\dot{L}_{it}}{L_{it}} = n \ and \ \frac{\dot{k}_{it}}{k_{it}} = \frac{\dot{K}_{it}}{K_{it}} - \frac{\dot{L}_{it}}{L_{it}}$, the evolution of capital-labour ratio can be written as follows:

$$k_{it} = \frac{\dot{K}_{it}}{L_{it}} - nk_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. (3.15)$$

Substituting equation (2.8) into equation (2.9) yield the following expression

$$\dot{k}_{it} = sf(k_{it}) - (n + \partial)k_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (3.16)$$

In the Solow's (1956) model, technological progress is considered exogenous with a constant and exogenously determined growth rate g. Thus:

$$A_t = A_0 e^{gt} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.\dots (3.17)$$

The introduction of the exogenously determined growth of technology modifies equation (3.16) so that the expression for the capital-labour ratio becomes

$$\dot{k}_t = sf(k_t) - (n + g + \partial)k_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (3.18)$$

In the steady-state, equilibrium $\dot{k}_{it} = 0$ and incorporating this condition in equation (3.18) yields

$$sf(k_{it}) = (n + g + \partial)k_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (3.19)$$

Equation (3.19) implies that growth disparities across regions occur not only due to differences in the growth of capital relative to labour, but also because of possible differences in technological progress. Persistent variations in rates of technological progress have the potential to accerelate or reduce the extent in which regions converge to each other. Equation 3.19 can be expressed as:

$$sy_t = (n + g + \delta)k_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (3.20)$$

From equation 3.20,

$$k_t = \frac{sy_t}{n+g+\delta} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. (3.21)$$

Assuming a cobb-douglas production function, equation (3.2) can be expressed as:

$$y_t = (k_t)^{\alpha} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.\dots\dots (3.22)$$

Substituting equation 3.21 into 3.22 yields:

$$y_t = [s/n+g+\delta]^{\alpha/1-\alpha} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..\dots.. (3.23)$$

Taking the natural logs of equation 3.23) gives a linear equation of the steady-state output per effective unit of labour given as:

$$\ln y_t = \frac{\alpha}{1-\alpha}\ln S - \frac{\alpha}{1-\alpha}\ln(n+g+\delta) \dots\dots\dots\dots\dots\dots\dots.\dots\dots\dots.. (3.24)$$

Table A 1: Stationarity test for growth convergence variables

Variable	Level	LLC		IPS		Conclusion
		t-statistic	P-value	t-statistic	P-value	
GDP Growth	Level	-2.793***	0.003	-4.390***	0.000	I(0)
Physical Capital	Level	-1.951**	0.026	-0.696	0.243	I(0)
Human Capital	Level	-4.480***	0.000	-0.103	0.151	I(0)
Trade Openness	Level	0.533	0.297	0.458	0.676	I(1)
	First Difference	-4.583***	0.000	-4.421***	0.000	
Government effectiveness	Level	-5.609***	0.000	-2.744***	0.003	I(0)
Inflation	Level	-3.109***	0.001	-3.350***	0.000	I(0)
Gross Government Debt	Level	-1.636**	0.051	0.259	0.602	I(0)
Foreign Direct Investments	Level	-1.895**	0.029	-2.101**	0.018	I(0)
Official Development Assistance	Level	0.853	0.803	-0.017	0.493	I(1)
	First Difference	-4.823***	0.000	-5.634***	0.000	
Remittances	Level	-1.533*	0.062	-1.338*	0.091	I(0)
Government Consumption Expenditure	Level	-1.251	0.105	0.208	0.583	I(1)
	First Difference	-4.759***	0.000	-4.267***	0.000	
Population growth Rate	Level	-3.405***	0.000	-0.114	0.455	I(0)
Government Savings	Level	-3.151***	0.001	-2.308***	0.011	I(0)
Exchange Rate Deviation	Level	-3.358***	0.000	-2.942***	0.002	I(0)
Business Cycles Asymmetry	Level	-1.239	0.108	-1.041	0.149	I(1)
	First Difference	-5.259***	0.000	-4.395***	0.000	
Trade Structure	Level	0.662	0.746	-2.472***	0.007	I(0)
	First Difference	-4.439***	0.000			
Bilateral Trade	Level	-0.746	0.228	-2.279***	0.011	I(0)
	First Difference	-5.920***	0.000			
Economic Size	Level	-1.411*	0.079	-2.284***	0.011	I(0)
Exchange Rate	Levels	-4.110***	0.000	-4.044***	0.000	I(0)
GDP	Levels	-2.805***	0.003	-4.041***	0.000	I(0)
Bank Credit to Private Sector	Levels	-0.922	0.178	-1.472	0.472	I(1)
	First Difference	-2.230***	0.013	-3.547***	0.000	
Money Supply	Levels	-1.573**	0.058	-0.396	0.346	I(0)
Fiscal Deficit	Levels	-2.137**	0.016	-1.326*	0.093	I(0)
Public Debt	Levels	-1.844**	0.033	-0.392	0.348	I(0)
GDP	Levels	-2.805***	0.003	-4.041***	0.000	I(0)
Current Account	Levels	-1.800**	0.036	-1.921**	0.027	I(0)
Political Stability	Levels	-1.353*	0.088	-2.552***	0.005	I(0)

Note: ***, **, * denote statistical significance at 1 per cent 5 per cent, and 10 per cent, respectively. I(0) and I(1) mean stationary at level and at first difference, respectively.
Source: Author's calculations from study data

Table A 2: Pairwise correlation matrix for growth convergence variables

	GDP Growth	Physical Capital	Human Capital	Trade Openness	Government Effectiveness	Inflation	Gross Government Debt	Foreign Direct Investments	Official Development Assistance	Remittances	Government Consumption Expenditure	Population Growth
GDP Growth	1											
Physical Capital	0.4	1										
Human Capital	0.2	0.5	1									
Trade Openness	0.1	0.4	0.7	1								
Government Effectiveness	0.5	0.4	0.4	0.2	1							
Inflation	-0.3	-0.1	-0.1	0.24	-0.24	1						
Gross Government Debt	-0.3	-0.6	-0.75	-0.55	-0.36	0.01	1					
Foreign Direct Investments	0.4	0.6	0.38	0.22	0.38	0.15	-0.5	1				
Official Development Assistance	-0.1	-0.5	-0.63	-0.42	-0.46	0.05	0.51	-0.32	1			
Remittances	0.2	0.1	0.67	0.33	0.25	0.1	-0.4	0.41	-0.26	1		
Government Consumption Expenditure	-0.3	-0.7	-0.26	-0.12	-0.49	0.09	0.28	-0.55	0.55	-0.16	1	
Population Growth	-0.1	0.1	0.04	0.042	-0.23	0.11	-0.01	0.12	0.12	0.2	0.02	1

Source: Author's own computation

Table A 3: Hausman test for exchange rate convergence

	-------Coefficients ----			
	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
t	-.0072913	-.0071755	-.0001157	.0039054
BCAss	1.499088	1.511328	-.0122395	.0572214
TS	.0021538	.001992	.0001619	.0008694
BT	-2.206682	-1.631831	-.5748517	.692649
DGE	.0680744	.0704413	-.0023669	.0124225
Size	.0310747	.0325274	-.0014527	.0470923

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)

0.81

Prob>chi2 = 0.9919

Table A 4: Hausman test for inflation convergence

	------ Coefficients ----			
	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
t	-.1048532	-.1023734	-.0024798	.0125149
DER	-.0430758	-.0750383	.0319625	.0467962
y	.1999508	.1728163	.0271345	.0310259
CP	-.0187416	-.0628235	.0440819	.0729749
M2	.203861	.2024823	.0013786	.0624765
r	.011904	.0151278	-.0032238	.0160627
Dp	.0004595	.0038532	-.0033937	.0118848
GE	.7427448	-.0962043	.8389492	.9263995

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(8) = (b-B)'[(V_b-V_B)^(-1)](b-B)

0.99

Prob>chi2 = 0.9983

Table A 5: Hausman test for fiscal deficit convergence

	-----Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fe	re	Difference	S.E.
t	.1987089	.2059285	-.0072196	.0155135
DivDtijt	.0124207	.015862	-.0034413	.0025923
DivGDPgijt	.1078717	.1256731	-.0178014	.0115181
DivInfijt	.0264815	.0335612	-.0070796	.
DivCAijt	.0094136	-.0082313	.0176449	.0079068
DDivGEijt	1.558619	2.07235	-.5137305	.1040705
DivPstabijt	.0591582	.3016638	-.2425056	.2590789

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic
chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
8.63
Prob>chi2 = 0.2801
(V_b-V_B is not positive definite)

Table A 6: Sargan test of over-identifying restrictions for absolute convergence

	Chi Square	**P- Value**
Growth Convergence in EAC	67.93297	0.6765

$H_{0:}$ overidentifying restrictions are valid

Table A 7: Arellano-Bond test for zero autocorrelation for absolute convergence

Order	**Z**	**Prob>Z**
1	-1.6595*	0.0970
2	-0.8071	0.4196

H_0: no autocorrelation

Table A 8: Sargan test of over-identifying restrictions for conditional convergence

	Chi Square	**P- Value**
Growth Convergence in EAC	86.4638	0.1524

H_0: overidentifying restrictions are valid

Table A 9: Arellano-Bond test for zero correlation for conditional convergence

Order	**Z**	**Prob>Z**
1	-1.7055*	0.0881
2	-0.8357	0.7033

H_0: no autocorrelation

Table A 10: Clemente-Montanes-Reyes unit root test with double mean shift at levels

Variable	Additive Outliers		Innovational Outliers	
	t-statistic	Optimal break points	t-statistic	Optimal break points
Exchange Rate (Burundi)	-0.210	1990, 1998	-4.479	1986, 1995
Exchange Rate (Kenya)	-0.232	1990, 1994	-0.877	1986, 1989
Exchange Rate (Rwanda)	-0.026	1992, 1997	-16.366**	1989 1993
Exchange Rate (Tanzania)	-3.378	1987, 1992	-145.483**	1984, 1991
Exchange Rate (Uganda)	-0.289	1986, 1989	-1.489	1986, 1988
Std. Dev. Exchange Rate	-0.311	1986, 1992	-6.073**	1989, 1991
Inflation Rate (Burundi)	-7.173**	1994, 1999	-6.618**	1994, 2000
Inflation Rate (Kenya)	-2.525	1991, 1996	-6.787**	1991, 1993
Inflation Rate (Rwanda)	-4.041	1990, 1995	-6.222**	1989, 1994
Inflation Rate (Tanzania)	-5.440	1988, 1997	-4.071	1990, 1996
Inflation Rate (Uganda)	-5.662**	2004, 2013	-5.630**	2004, 2011
Std Dev Inflation Rate	-6.595**	1995, 1999	-6.314**	1995, 2000
Budget Deficit (Burundi)	-3.514	2003, 2008	-5.860**	2005, 2014
Budget Deficit (Kenya)	-3.198	2007, 2013	-4.246	2006, 2012
Budget Deficit (Rwanda)	-6.099**	2001, 2011	-4.802	2002, 2010
Budget Deficit (Tanzania)	-3.648	2003, 2016	-3.765	2003, 2016
Budget Deficit (Uganda)	-5.295	2003, 2007	-4.460	2001, 2008
Std Dev Budget Deficit	-3.470	2008, 2014	-5.540**	2003, 2005

Notes: Critical values at 5 per cent significance level is -5.490
H_0: Has unit root (Nonstationary)
** Denotes rejection of null hypothesis at 5% level of significance

Table A11: Multicollinearity test (VIF test of growth convergence variables)

Variable	VIF	1/VIF
Human Capital	8.38	0.1193
Exchange rate	6.96	0.14375
Official Development Assistance	5.52	0.18103
Government Effectiveness	4.18	0.23928
Gross Capital Formation	3.57	0.28041
Government Consumption Expenditure	3.26	0.3071
Gross Government Debt	2.46	0.40569
Trade Openness	2.29	0.43734
Foreign Direct Investment	2.25	0.44493
Population Growth Rate	1.11	0.89794
Mean Variance Inflation Factor (VIF)	4	