FEASIBILITY OF A MONETARY UNION IN EAST AFRICAN COMMUNITY

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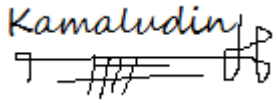

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ABSTRACT

In recent years, the pursuit and interest of monetary union has become important phenomenon of economic development. Many countries in the world have the incentive to form monetary union with the intention of enjoying the benefits of increased economic integration and to avoid the monetary domination of larger countries. East African Community (EAC) like other regional economic blocs is interested to form monetary union in order to access wider market and reinforced growth, which subsequently results in higher level of economic welfare. EAC consists of five neighbouring countries, situated in the eastern part of Africa and they are Burundi, Kenya, Rwanda, Tanzania and Uganda. So far, these countries have made considerable achievements towards the formation of monetary union as they had established a Customs Union in the 2005 and Common Market in the 2010, these achievements allow free movement of goods, services, capital and labour in the block.

The aim of this thesis was to assess the suitability of a monetary union among the five EAC member countries in the light of optimum currency area criteria (OCA) theory. The study reviewed and discussed the socio-economic background and the macroeconomic characteristics of the EAC member countries. Similarly, the study reviewed the literature and theoretical foundations of OCA theory and its related empirical studies. For the methodological part, this study mainly emphasises on the economic elements of a monetary union using two major econometric methods to analyze the feasibility of monetary union in EAC countries. First, a four-variable structural vector auto-regression (SVAR) model was used to identify four types of shocks: global supply shock, domestic supply shock, monetary supply shock, and domestic demand shocks; then we measure the symmetry and asymmetry of these shocks using simple correlation analysis, impulse response analysis, variance decomposition analysis, and lastly one-way Anova analysis. The second method used was business cycle synchronization analysis of HP (Hodrick-Prescott) and the BP (band pass) filters. After identifying the cycles and trends, the study applied cross country correlation analysis and analysis of variance technique to examine whether EAC countries are characterized by synchronized business cycles or not.

The findings of the study did not show strong support for the formation of a currency union in the region at present, but nevertheless it gave some hope to a successful monetary union in the future. The study found that both the degree of symmetric shocks and business cycle synchronization in the EAC bloc had increased significantly for the last ten years. On the other hand, the correlation of shock analysis revealed that domestic demand shocks and external supply shocks were dominant in the region, while domestic supply shocks and monetary shocks were less correlated and asymmetry in the region. For the business cycle analysis, the results showed that EAC countries are similar in cycle components but do differ in permanent components especially in growth trend. Most of the study results were in line with previous studies. In conclusion,

single currency for this region is an excellent idea and is believed to be an achievable target; but before that EAC countries need to implement rigorous policy co-ordination in order to achieve the desired level of symmetry of shocks and business cycle synchronization.

ABSTRAK

Kebelakangan ini, usaha dan minat ke arah penubuhan kesatuan kewangan telah menjadi fenomena penting dalam pembangunan ekonomi. Banyak negara memiliki insentif untuk membentuk kesatuan kewangan dengan tujuan menikmati faedah dari segi peningkatan integrasi ekonomi dan mengelakkan dominasi kewangan oleh negara-negara yang lebih besar. Seperti blok ekonomi serantau yang lain, Komuniti Afrika Timur (East African Community/EAC) mempunyai minat untuk membentuk kesatuan kewangan bagi membolehkan mereka mendapat pasaran yang lebih luas serta memperkukuh pembangunan, seterusnya meningkatkan tahap kebajikan ekonomi. Komuniti Afrika Timur terdiri daripada lima negara berjiran yang terletak di bahagian timur Afrika, iaitu Burundi, Kenya, Rwanda, Tanzania dan Uganda. Setakat ini, negara-negara tersebut telah mencapai banyak kejayaan ke arah pembentukan kesatuan kewangan sejak penubuhan Kesatuan Kastam pada tahun 2005 dan Pasaran Bersama pada tahun 2010. Kejayaan ini telah membolehkan pergerakan bebas barangan, perkhidmatan, modal dan buruh dalam blok tersebut.

Objektif tesis ini adalah untuk menilai kesesuaian penubuhan kesatuan monetari di kalangan lima negara EAC dengan mengambil kira kriteria teori Kawasan Mata Wang Optimum (Optimum Currency Area/OCA). Kajian ini telah meninjau dan membincangkan latar belakang sosio-ekonomi serta ciri-ciri makroekonomi negara-negara EAC. Kajian ini turut mengulas tinjauan kajian lepas dan asas-asas teori OCA serta kajian-kajian empirik yang berkaitan. Dari segi metodologi, kajian ini menekankan elemen-elemen ekonomi kesatuan kewangan menggunakan dua kaedah ekonometrik untuk menganalisa kesesuaian penubuhan kesatuan kewangan untuk negara-negara EAC. Untuk kaedah pertama, model Auto-regresi Vektor Struktural (Structural Vector Auto-Regression/SVAR) dengan empat pembolehubah telah digunakan untuk mengenalpasti empat jenis kejutan, iaitu: kejutan bekalan global, kejutan bekalan domestik, kejutan bekalan kewangan dan kejutan permintaan domestik. Seterusnya, kami telah mengukur simetri dan asimetri bagi setiap kejutan tersebut menggunakan analisis korelasi mudah, analisis sambutan impuls, analisis penguraian varians, dan analisis Anova sehala. Kaedah kedua yang telah digunakan adalah analisis penyelarasan kitaran perniagaan HP (Hodrick-Prescott) dan turas jalur (band pass/BP). Selepas mengenalpasti kitaran dan tren, analisis korelasi rentas negara dan analisis varians telah dilaksanakan untuk menguji sama ada negara-negara EAC menunjukkan ciri-ciri kitaran perniagaan terselaras atau tidak.

Dapatan kajian tidak menunjukkan sokongan yang kuat bagi pembentukan kesatuan kewangan di rantau tersebut pada masa kini, walau bagaimanapun ia memberi sedikit harapan unuk menjayakan pembentukan kesatuan kewangan pada masa hadapan. Kajian ini mendapati bahawa tahap kejutan simetri dan penyelarasan kitaran niaga dalam blok EAC telah menunjukkan peningkatan yang signifikan dalam sepuluh tahun kebelakangan ini. Korelasi analisis kejutan pula menunjukkan bahawa kejutan permintaan domestik dan kejutan bekalan luar adalah dominan di rantau tersebut, manakala kejutan bekalan domestik dan kejutan kewangan kurang berkorelasi dan tidak simetri. Bagi analisis kitaran niaga, hasil kajian menunjukkan bahawa negara-negara EAC mempunyai kitaran yang serupa tetapi berbeza dari segi komponen-komponen tetap, terutamanya tren pembangunan. Kebanyakan hasil kajian adalah selari dengan hasil kajian-kajian sebelum ini. Kesimpulannya, langkah mewujudkan matawang

tunggal di rantau ini merupakan satu cadangan yang bernas dan boleh dicapai. Walau bagaimanapun, negara-negara EAC terlebih dahulu perlu melaksanakan polisi koordinasi yang rapi bagi mencapai tahap kejutan simetri dan penyelarasan kitaran perniagaan yang dikehendaki.

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Kamaladin Ahmed Sheikh

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LIST OF ABBREVIATIONS

EAC	East African Community
GCC	Gulf Cooperation Council
EMU	European Monetary Union
MU	Monetary Union
OCA	Optimum Currency Area
AS	Aggregate Supply
AD	Aggregate Demand
WAEMU	West African Economic and Monetary Union
WTO	World Trade Organization
IMF	International Monetary Fund
WB	World Bank
ANOVA	Analysis of variance
BP	Band-Pass filter
HP	Liquid Chromatography-Mass -Spectrometry
CV	Coefficient of Variance
BC	Business Cycle
ASEAN	Joint United Nations Program on HIV/AIDS
CU	Customs Union
COMESA	Common Market for Eastern and Southern Africa
ECOWAS	Economic Community of West African States
RER	Real Exchange Rate
FTA	Free Trade Area
WAMZ	West African Monetary Zone
SACU	Southern African Customs Union
VAR	Vector Auto Regresive
KPSS	Kwiatkowski–Phillips–Schmidt–Shin
ADF	Augmented Dickey–Fuller test
IRF	Impulse Response Function

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DEDICATION

This work is dedicated to my parents - my father **Ahmed Sheikh Mohamud** and my mother **Halima Mo'alim Abdulle**. To them I am indebted and I do not have words to express my gratitude. I say:

رَبِّ ارْحَمْهُمَا كَمَا رَبَّيَانِي صَغِيرًا

(O Allah, Have mercy upon them – my beloved father and mother – as they did care for me when I was young).

It is also dedicated to my beloved wife '**Safia Hussein**,' brothers and sisters for their patience, care, love, encouragement and a whole unreserved support during my study.

CHAPTER 1
INTRODUCTION

1.1 Background

In recent years, the pursuit and interest of a currency union has become an important phenomenon in economic development. Many countries in the world have the incentive to form monetary unions with the intention of enjoying the benefits of increased economic integration and avoid the monetary domination of larger countries. Thus, the interest of having a monetary union among academics and policy makers had drastically increased; most of the scholars and policy makers have a favourable view about it (Adams, 2005). The largest Economic and Monetary Union at present is the European Monetary Union (EMU) and the majority of literature on monetary integration pertains mainly to the European region.

The East African Community (EAC) region is one of the regions interested in forming a monetary union; they had been planning on economic integration since 1999 (EAC, 2010). The main goal of the EAC is to progress the economic, social and political integration of the region so as to gain wealth and enhance competitiveness through increased production, trade and investment (EAC, 2010). The East African Community is a region which has a number of similarities and disparities with the EU. However, it has its own merits and demerits in many ways. Thus, a direct currency union model (monetary union model) borrowed from other contexts may not work in Africa due to its political, social, educational, ideological, cultural and other understanding gaps (Masson & Pattillo, 2004). Considering these points of view, the aim of this study is to assess the economic feasibility of the proposed monetary union in the EAC by examining the degree of symmetry of shocks and synchronization of business cycles (dynamics of trends and cycles) among the member countries of the East African Community.

Several studies have paid attention to assess the feasibility of a currency union in East Africa (Bayoumi & Ostry, 1995; Buigut, 2006; Buigut & Valev, 2005a; Kishor & Ssozi, 2011; Mafusire & Brixiova, 2012; Masson & Pattillo, 2004; Mburu, 2006; Mkenda, 2001). However, the results of these studies mainly depend on a limited number of OCA criteria to find out reliable candidates to form a monetary union. On the contrary, this study concentrates on evidences from the application of various OCA criteria – traditional OCA criteria as well as new OCA approaches – in order to enrich the empirical evidences on the viability of a currency union in the EAC.

The concept of currency areas was started by Robert Mundell through his seminal paper titled 'A Theory of Optimum Currency Areas' (1961), followed by Mckinnon (1963) and Kenen (1969); these authors are the founders of the traditional Optimum Currency Area Theory (OCA). Their aim was to identify a technique to assess for a possible integration of a country to a currency area. The strategy contains a set of methods to identify the costs and benefits of joining currency area by a given country. If the benefits for each country wishing to join monetary union are higher than the costs, that means monetary area is referred to as optimal (Ben, 2009).

Usually, the suitability of currency unions is analyzed through the OCA theory which provides properties or criteria for determining whether countries or a particular group of countries are best suited to form a monetary union. In addition, the OCA theory can be viewed as a tool to find the answer to the question on how to choose the optimum exchange rate regime. OCA theory is divided into two main parts, the "Traditional OCA Theory" and the so-called "New OCA Theory" (Broz, 2005). Optimum currency area is discussed at length in chapter three – theoretical framework and literature review.

The methodological framework of this thesis is based on the two branches of optimum currency area theory: traditional OCA theory (trade openness, factor mobility, product diversification, similarities of production & inflation rates, intra-regional trade intensity, etc.) and the new OCA theory (asymmetry of shocks and business cycle synchronization). Specifically, this study concentrated on the new OCA theory paradigm to assess whether or not the EAC countries face similar disturbances. The new OCA approach is known as the "meta property analysis" of the OCA theory because it captures the interaction between several OCA properties (Mongelli, 2002). The Meta property approach is extensively used in the OCA literature as a tool to determine whether future members of a currency union face symmetric shocks or synchronized business cycles. Two econometric models of the Meta property analysis (SVAR and BCS) were used to assess whether the EAC countries face similar disturbances.

To have a single currency for this region is an excellent idea since it would reduce business transaction costs, facilitate the distribution of commodities and generate wealth through competition which boosts the innovation and efficiency of the region. However, there are fears that a single currency may not be a realized at this time due to the fact that some of the pre-conditions of a monetary union are still unfulfilled. As would be indicated in the next chapter of social and macroeconomic background of the region, EAC countries have great potential to become a viable unified currency area, as they have taken a number of steps to integrate their economic and financial systems. Thus, forming a monetary union in the EAC is believed to be an achievable target.

1.2 Problem statement of the study

EAC had revived in the year 2000 to realize the visions of the founding fathers of the 'Old EAC' with a view to better respond to the challenges facing the community in this era of globalization. Monetary union has become an attractive economic transformation strategy for the developing world. For that reason, the current leaders of East African Community have charted a road map of economic integration to get sustained economic development across the region. Monetary union is expected to help businesses to eliminate the risks and costs associated with currency fluctuations and this will contribute to the reduction in intra-regional trade costs (A. K. Rose & Stanley, 2005). The policy makers of the five EAC member countries believe that the monetary union is an indispensable tool for the transformation and growth of economy in the region; it can serve as a means of getting access to a wider market and strengthen growth in order to achieve a higher level of national welfare (Jovanovi, 2006).

As indicated by the IMF trade statistics (2010), the East African community is an integrated trade zone that has higher intra-regional trade share of 17% as a total foreign trade excluding the informal trade; this amount is relatively big compared to the other African regions. This huge cross-border transaction requires local traders and individual travellers to either change their money into US dollars or convert it from one national currency to another; this process on average claims 20 percent of the money value (Gor, S. O. 2011). According to the OCA theory, the existence of separate currencies reduces the volume and welfare gains of international trade through several channels, including the cost of currency conversion, exchange rate risk, and the need to maintain large liquid foreign exchange reserves. Thus, monetary union is indispensable tool to eliminate these problems; the currency conversion costs and exchange rate risks between the member states (Rose A. K. & Stanley, 2005).

In the past, the East African community members did not have successful monetary policies, but they are currently interested to form concrete macroeconomic policies in order to foster the economic stability and social welfare of the region. A monetary union which entails supranational monetary authority has the potential to give prudent monetary policies compared to central banks of the individual countries (Guillaume, and Stasavage 2000). Mundell (2002) proposed that members of a monetary union could simply have reliable macroeconomic policies. For instance, Guillaume and Stasavage (2000) explained empirically that members of monetary union in the African continent tend to pursue more credible monetary policies compared to non-members of monetary union. Similarly, Herrendorf (1997) and Ozkan (1994) argue that in a monetary union, countries with greater reputation in monetary policy could transmit their credibility to countries with less prudent monetary policy. For example, a country with a reputation of having a high inflation rate like Burundi could attain a low inflation reputation overnight by surrendering itself to the control of the central bank without any loss of output and employment.

On the other hand, the East African Community members had experienced some major conflicts in the past, such as the Ugandan civil war in the early 1980s, Burundi and Rwanda civil wars in 1990s, and the Kenyan violence during the presidential elections in 2003 and 2009. Thus, it is believed that a deeper regional integration can play a major role in promoting regional stability as well as offer a discussion platform for common political problems and external threats. Deeper integration promotes political cooperation, peace, stability and security through joint efforts with the union. Finally, despite the importance of a monetary union initiative & significant efforts made by the EAC towards forming a monetary union, there is concern that not enough empirical economic research has been conducted on this issue to support the initiative. This thesis contributes to the existing insufficient empirical literature on the subject of viability of monetary union in EAC.

1.3 Research Questions

The focus of this study is to apply the optimum currency area theory. For this purpose, the study considered the five East African countries as a case. Given the importance of the argument discussed in the introductory section, the research questions of this study are as follows:

- How do the business cycles and trends of EAC countries behave?
- How do macroeconomic shocks such as supply shocks, price shocks, monetary shock and global shock affect the economy of the EAC region?
- What are the shares and trends of trade between the EAC countries?
- How significant are the mean differences between business cycles of the EAC member countries?
- How significant are the mean differences between the macroeconomic shocks of the EAC member countries?
- How does the East African Community region meet the traditional OCA theory, which is a set of preconditions to judge the optimality of a currency area?

1.4 Objectives of the Study

The main objective of this thesis is to examine whether the East African Community countries can form a monetary union in light of the optimum currency area theory. Specific objectives of the study include:

- To identify and compare the macroeconomic shocks (demand shock, supply shock, monetary shock and global shock) affecting members of the East African Community region, since identifying the nature of these shocks will help to recognize whether the EAC members are suitable candidates to form a monetary union.

- To study the cyclical behaviour of EAC economic aggregates (business cycle); this is an important tool to determine whether or not the current EAC country members belong to the optimum currency area; as business cycle synchronization is regarded as a sign of convergence in a monetary union area.
- To test whether or not there are statistical differences between the average values of economic shocks and cycles of the EAC members by using ANOVA technique.
- To test how the traditional OCA criteria fits in the context of the East African Community
- To draw policy implications for macroeconomic stabilization policies and regional coordination policies based on the findings of the study.

1.5 Scope and Limitation of the Study

The scope of this study is the feasibility of monetary integration in the EAC region, which consists of five countries: Burundi, Kenya, Rwanda, Tanzania and Uganda. Data used in this study is the yearly time series data, mainly from the World Bank, IMF and EAC statistics department web site. So far, the following are the limitations of the study:

1. Macroeconomic fluctuations are short-run in nature, thus a more frequent data series such as quarterly data may be more advantageous in producing a better outcome. Not all of the macroeconomic variables in the EAC region are available as quarterly series; instead, annual series are available and therefore used for this study. In other words, VAR estimation using annual data may not pick up some short-run interactions that occur among the variables within a year.

2. The time series data that are available for some EAC countries are not very big, and as we go back to the early years we would find missing data, thus causing it to not be at par with the data for the European region or other developed countries. Nevertheless, the EAC countries are currently trying to build quality statistical data.
3. The researcher did not include in the modelling part any variables related to trade and politics; we merely focused on the feasibility side and used only macro-economic variables. Obtaining such variables in the EAC region is very difficult.

1.6 Significance of the Study

This thesis contributes to the current varied discussions in several ways: first, this study examines the viability of a monetary union in the East African Community region using varied econometric techniques (to check the robustness of the results). Secondly, it presents the costs and benefits of the formation of a monetary union for the EAC member states as well as comprehensive characteristics of the economic structure of the region. Thirdly, empirical findings gained from this study would contribute to the scarce scholarship and literature in the field of EAC monetary union. Fourthly, this study explores the policy implications of a monetary integration for the East African Community which would help EAC policy makers to formulate suitable monetary integration policies. Finally, this study provides more comprehensive and in-depth analysis of feasibility of monetary union in EAC

1.7 Contributions of the Study

This study is different compared to previous studies on the application of the OCA to form a monetary union in the East African Community in four ways:

- First, previous studies of monetary union in EAC have used 2-variable VAR model (Buigut, 2006; Mburu, 2006) which is too restrictive and potentially misleading (Guo, 2005). Hence, this thesis extends the 2 VAR model into a 4 VAR model.
- Secondly, this thesis is different because it covers more OCA criteria to determine whether the East African countries are plausible candidates for forming a monetary union; the study uses data from a longer sample period (1980-2010) as opposed to 1970-2001 for Buigut, 2006; and 1970-2003 for Mburu, 2006. Moreover, data in the earlier studies of Buigut and Mburu did not cover the economic conditions on structural change after the establishment of the EAC Custom Union (2005) and Common Market (2010). Thus, more recent data is necessary for the analysis of a monetary union in the EAC region.
- Thirdly, to the best of our knowledge, this study is the first to assess the business cycle synchronization of the EAC countries using different filters. Mburu, 2006 had studied the synchronicity of the business cycle of the EAC region using only one filter, which was the Hodrick-Prescott filter. This would make our results more robust. In order to get more robust and vigorous results, this thesis employs two different filtering methods adopted in the literature for the decomposition of GDP into a permanent component and a cyclical component.
- Finally, this thesis attempts to develop a new way of analysing monetary unions based on the two-Way-Anova techniques for the purpose of decomposing the variation in the series into country-specific characteristics. Using the two-Way-Anova techniques, we tested whether or not there is a difference in the mean of economic shocks & business cycles of the five EAC member countries.

1.8 Operational Definitions of the Study

This section presents the definitions of the different economic terminologies in order to facilitate the understanding of those who are not very familiar with economic jargons.

- Optimum Currency Area theory (OCA): this can be described as the irrevocably pegged exchange rates of several currencies or simply the most favourable geographic domain of a single currency (Mongelli, 2002). In other words, OCA is a tool often used to evaluate the feasibility of monetary integration.
- Shocks: any kind of disturbances that disrupts the normal functioning of the production and exchange processes.
- Monetary Union: entails the irreversible fixing of the exchange rates with a common monetary policy. Others define monetary union as a union of two or more states that share the same currency and consider it as the fourth stage of economic integration.
- Business cycle synchronization: the degree of co-movements of the fluctuations across economies and time; it checks whether or not a group countries are affected by common fluctuations.
- Cycle: the difference between two turning points of the same nature
- Phase: the difference between a peak and a trough
- De-trending: statistical method used to remove the cyclical variations in a trend
- Turning point: occurs when the deviation-from-trend series reach a local maximum (Peak) or a local minimum (Trough).

1.9 Organization of the Study

Chapter one − Introduction:

This is an overview chapter of the study. It provides background information about the East African Community followed by a Problem Statement of the Study, Research questions, Research Objectives, Scope and Limitation of the study, Significance of the Study, Contributions of the study, Operational Definitions of the study and finally the Organization of the study.

Chapter two – Socio-economic of the East African Community

This chapter describes the socio-economic background of the East African Community region. It starts with the history of regional integration of the East African Community followed by the second section which presents the general characteristics of the East African community. The third section explores how a set of preconditions from the traditional OCA theory is explained in the context of the East African Community in order to determine whether the EAC region qualifies as an optimum currency area.

Chapter three – Discussion of Theory and Literature Review:

This chapter reviews the theoretical foundations and empirical studies of the Optimum Currency Area (OCA) theory. It starts with classical contributions of the OCA theory which proposes a set of preconditions that potential monetary union members should fulfil prior to forming a monetary union. The second part of this chapter presents the modern treatment of the OCA theory, which is referred to as the "New OCA" theory. This theory questions the validity of certain traditional OCA properties. Then, it is followed by past empirical studies of the OCA across the world. Finally, we present the business cycle synchronization in order to understand the feasibility of a monetary union and followed by past empirical studies on business cycle synchronization.

Chapter four − Research Methodology:

This chapter provides research methods used in the study. It explains the analytical framework of the study, research design, sources of data and primary analysis, parameter stability, econometric models and their identification strategies, etc. This chapter provides three econometric approaches to analyse the feasibility of a monetary union in the East African community region. The first approach is the Structural Vector Auto-regression approach which is premised on aggregate demand and aggregate supply framework. The second method of analysing the feasibility of a monetary union is based on the convergence of business cycles (synchronization of business cycle). The third method of analysis used in this study is based on the ANOVA "analysis of variance" which is used to determine the statistical significance of the differences between the means of two or more groups of values.

Chapter five – Results and Discussion:

The results of this study are presented in this chapter. The chapter presents the results of the preliminary analysis of data such as the unit root test and diagnostic test, followed by a summary of results and discussions of the different models used in this dissertation. The results for the EAC countries are compared with the results for the EU monetary union since EMU had been successfully implemented.

Chapter six − Conclusions and Recommendations:

In this chapter, we draw the conclusions based on the overall findings of this study. Several policy implications and suggestions for further research are presented at the end of the chapter.

CHAPTER 2

SOCIAL AND ECONOMIC BACKGROUND OF EAST AFRICAN COMMUNITY REGION

This chapter reviews the social and economic background of the East African Community region; it examines the performance and general trend of the region towards forming a monetary union. It further presents the assessment of the performance and similarity in the key sectors of trade, policy discipline, macroeconomic indicators, industry and agriculture. It also presents some highlights of how the East African Community countries qualify for the traditional OCA criteria. The chapter is organized as follows: it starts with the history of regional integration of the East African Community followed by the general characteristics of East African community. The chapter continues by presenting an evaluation of how the East African Community meets the traditional OCA criteria and finally concludes with some closing remarks.

2.1 History of Regional Integration in EAC

The East African Community (EAC) is a regional organization which consists of Burundi, Tanzania, Uganda, Rwanda and Kenya. Their objective is to strengthen the co-operation in the fields of economics, politics, social and cultural among the EAC member countries (EAC, 2009; Goldstein & Njuguna, 2001). This region had a closer economic integration before independence (Hazlewood, 1979) and they share many things in common such as history, language (Kiswahili & English), culture and infrastructure (Mburu, 2006). The EAC regional block is unique as it is the only regional block in Africa which had made considerable achievements toward economic integration (Zingoni, 2010). The history of regional integration of the East African Community is divided into two main parts: the Old East African Community (1967-1977) and the Revival of the East African Community (2000 until present).

2.1.1 The Creation and Demise of the "Old" EAC (1967-1977)

The history of economic co-operation between the East African countries dates back to the early 20th century; since then, East African countries had undergone several succeeding regional integration arrangements. In 1917, Kenya and Uganda had agreed upon a "Customs Union" and later in 1927 Tanganyika joined in. In the period between 1948 and 1961, there existed a regional cooperation known as the East African High Commission. In 1967, Tanzania, Kenya, and Uganda formed the East African Community which had later collapsed in 1977 due to political dispute between member countries, but in 1993 the idea of regionalism in the region was revived and led to the formation of the East African Co-operation (1993-2000). Finally, in 2000 the current East African community was contracted (EAC, 2009).

According to history, the major regional cooperation between EAC countries had started in December 1967when three members of the current EAC countries (Uganda, Kenya and Tanzania) had officially agreed to set up the East African Community, signed in Nairobi, Kenya (Kasaija, 2004). Their main objective was *"to reinforce the regional cooperation of the partner states, in order to get sustained economic development across the region where they implement economic policy harmonisation, joint projects and consultation in areas of agriculture, power, education, transport and so on"* (EAC Co-operation Treaty, 1967). These three countries (Kenya, Uganda and Tanzania) had formerly been under the British colony, and as a result, EAC countries had bequeathed a number of common things which were seen as important factors for the arrangement of regional integration (Zingoni, 2010). They had identical government administration, culture, judicial system, schools, and institutional framework which enabled the community to be established. Until 1966, these countries were using the same currency the of shilling (Mvungi, 2002).

Although EAC countries enjoyed a number of similarities between them, some remarkable differences had emerged which later led to the abortion of the former project of EAC integration. These differences disabled the union to sustain for much longer, and it was eventually terminated in 1977 due to multiple ailments such as failed negotiations, conflicts of interest, lack of political will and different political ideologies (e.g. Kenya favoured the capitalist ideology, while Tanzania favoured the socialist ideology) (Hazlewood, 1979; Jovanovi, 2006; Zingoni, 2010). The strongest blow to the existence of EAC union came in 1971, when Idi Amin seized the Ugandan power with a military coup. The newly born government of Idi Amin had adopted the Communist ideology, which implemented nationalism and Africanise schemes and expelled the Asian entrepreneurs from the country. Amin's regime confronted the implementation of harmonization policies and rule of law in the region (Goldstein & Njuguna, 2001). However, things deteriorated when Tanzania refused to recognise Idi Amin's government while Kenya had recognized it (Mugomba, 1978; Ravenhill, 1979).

In addition, the political problems had also effected the economy of the region; in the period between 1971 and 1977, EAC countries had reacted differently to the external economic shocks of the first world oil price shocks in 1973 (Goldstein & Njuguna, 2001). These differing economic systems made the partnership more and more difficult. Similarly, during the economic boom between 1976-1977, members of EAC had reacted differently by adopting different economic strategies in response to this economic shock (Goldstein & Njuguna, 2001). These deadlocks had necessitated the collapse of the scheme as there would be no harmonized decisions pertaining to the common interest of the community (Mvungi, 2002). Other factors which ruined the old EAC include the luck of good monetary policies, luck of exchange rate control and political conflicts (Mwase, 1979). Eventually, member states of the community failed to pay their dues to the community and consequently the EAC broke down in 1977.

2.1.2 The Revival of the East African Community

After the termination of the former EAC in 1977, members of the former EAC had a meeting in 1984 and discussed about the feasibility of future cooperation and strategies to increase co-operation in economics. Following that meeting, in November 30th 1993 members of the three Heads of State (Kenya, Tanzania and Uganda) had signed an agreement to establish the Permanent Tripartite Commission for the East African Co-operation. The current East African Community was fully established on 30th November 1999, when the three original partner countries of Tanzania, Kenya, and Uganda had signed an agreement of the re-establishment of the former EAC in Arusha, Tanzania; this agreement came into force on 7th July 2000 (Morrissey & Jones, 2008).

On 1st July 2007, two new countries - Rwanda and Burundi - joined the community and made the union to be consisted of five countries (EAC, 2009). More recently, the newly formed state of South Sudan (Juba) had submitted a membership application to the EAC headquarter in Arusha. The currently renewed and reinvigorated East African Community seems to differ greatly from the old EAC which existed in 1967-1977. The current EAC had undertaken great efforts towards forming a monetary union; it displayed a strong political will and had taken remarkable steps towards the formation of a monetary union (Buigut, 2006, p. 40). The current EAC had expressed the plan to launch the following set of sequential tasks: Customs Union, Common Market, Monetary Union, and finally a Political Federation. The reason behind these initiatives is to strengthen and regulate the economical, political, social, cultural and other relations in the community in order to achieve a harmonized and balanced development with sustainable economic growth that will be shared equitably (Kamanyi, 2006).

To date, the East African Community had taken giant leaps towards an economic union. They had formed a preferential trade area (PTA) and free trade area (FTA) in 1993 and 1996 respectively, and in 2005 they had established a Customs Union. On the 30th of June 2010, member states of the EAC simultaneously launched the Common Market Protocol, which allows free movement of goods, services, capital and labour within the block. They are subsequently planning to implement a Monetary Union by the year 2015 and afterwards a Political Federation of East African States (Buigut S. K. & Valev, 2005b). The East African Community operates on the basis of a five-year development strategy that lays out policy guidelines and priority programs as well as implementation schedules. So far, there are 3 EAC Development Strategies.

The first EAC Development Strategy (1997-2000) was designed to re-launch the East African co-operation. In the first Strategy (1997-200), EAC countries had implemented key policies such as the harmonization of fiscal and monetary policies among member countries, easing of cross border movements of goods and persons, free movement of capital development of infrastructure, enhancement of technological and human resources development and strengthening of institutions of co-operation (Mburu, 2006). The second EAC Development Strategy (2001-2005) was intended to consolidate the East African Cooperation in the launching of the East African Customs Union with took effect from 1st January 2005. The 3rd EAC Development Strategy (2006-2010) strategy was designed to consolidate and complete the E.A Customs Union, establish the EA Common Market and lay the foundations for an EA Monetary Union and EA Political Federation. This makes the 3rd EAC Development Strategy (2006-2010) the most important and the period as the most complex in the East African integration.

2.2 General Characteristics of East African Community

Having considered the history of the formation of the community, it would be worthwhile to analyze the economic performance of the region as the overall economic performance determines the successfulness of the formation of a monetary union in the region. This section provides an overview of the economy of the EAC. It is divided into two subsections; subsection 2.2.1 presents a comparison of macroeconomic variables of the East African Countries whereas subsection 2.2.2 provides some information about the political & economic systems of the East African Community.

2.2.1 Comparison on Some Macroeconomic Variables of EAC

The land surface area of the East African Community is estimated to be 1.82 million sq kilometres with a combined population of 133.1 million and huge natural resources. Table 2.1 provides selected social and macroeconomic indicators of the EAC countries. As can be seen from the table, East African countries vary significantly in terms of geographical size and population size. Tanzania is the largest country, followed by Kenya and Uganda. Rwanda and Burundi are of rather the same size, much smaller than the other three. Kenya and Tanzania both have a long coastal stretch while the other three countries (Burundi, Rwanda and Uganda) are landlocked. Refer to Figure 2.1 to see the map of East African Countries in the context of the big map of Africa. In terms of the human development index of the region, Kenya is currently leading and Uganda is at the second place; these two countries rank 128th and 143rd in the world human development ranking, respectively. Tanzania and Rwanda are ranked 148th and 152nd in the world human development ranking, respectively while Burundi is ranked 166th,which puts the country at the lowest spot in terms of human development compared to the other EAC members. In the aspect of life expectancy, Tanzania has the

biggest life expectancy (56.9 years), followed by Kenya with a life expectancy of 55.6 years. Rwanda has the smallest life expectancy at birth in the region (51.1 years).

Figure 2.1: Location of EAC (the coloured area): Source Wikipedia

Regarding the gross domestic product (GDP), Table 2.1 provides a comparison of real GDP in US dollars for the 5 EAC countries in the year 2010. The EAC region has a combined GDP of 79.2 billion US dollars with an average GDP per capita of $685 (EAC, 2011). The table also shows that for the year 2010, Kenya had the highest real GDP compared to the rest of the EAC countries with a figure of 18,543 million US dollars. Tanzania is at the second spot, followed by Uganda and Rwanda; each had scored 11,941 million US dollars, 9,539 million US dollars and 4,033 million US dollars respectively. Burundi remained at the bottom spot in the region for its real GDP output, with merely 1,499 million US dollars.

Concerning real growth rates, the region had recorded a combined average real growth of ~ 5 percent (2009) which makes it one of the fastest growing regions in the world. Table 2.1 shows the data for the specific annual growth rate of each EAC country. For the year 2010, Rwanda had the highest economic growth rate of 7.5 percent; Tanzania was the second highest with 7.0 percent, while Uganda and Kenya attained a similar growth rate of 5.6 percent. Burundi has the lowest economic growth, although the country recorded an increased growth rate of 3.9 percent compared to 3.5 percent in the previous years (EAC, 2011).

In the year 2009, the EAC region had shown a combined annual inflation rate of11.09 percent. Individually, Uganda had the highest annual inflation rate of 12.72 percent, Tanzania had the second highest annual underlying inflation rate with 12.14 percent and Burundi ranks third with an annual underlying inflation rate of 10.98 percent. Both Rwanda and Kenya had the lowest annual underlying inflation rate in the region with a value of 10.36 and 9.23 percent respectively (WDI, 2009).

Table 2-1: EAC macroeconomic indicators (2009)

States/Years	Burundi	Kenya	Rwand	Tanzani	Ugand	EAC
Total Surface Area						
Including water ('000 sq km)	27.8	939.3	241.6	582.7	26.3	1,817.7
Excluding water ('000 sq km)	25	886.3	199.8	580.7	24.2	1,716.0
Population						
Total (in millions)	8.2	38.3	9.83	40.7	29.6	**126.6**
Growth (annual %)	2.8	2.6	2.8	2.9	3.3	2. 9
Density (people/sq km)	31	68.0	394	48	161	985
Human Development						
Human Development Rank	166	128	152	148	143	-----
Human Development Index	0.3	0.5	0.4	0.4	0.4	0.4
Life expectancy at birth yrs	51.4	55.6	51.1	56.9	54.1	53.8
Gross Domestic Product						
GDP (constant 2000 US$)	0.930	18,543	3.206	16.239	11.973	50.33
Growth (annual percent)	3.9	5.6	7.50	7.00	5.1	5.1
Per capita (constant 2000 $)	112	452	320	382	336	320
FDI, net inflows (% of GDP)	0.03	0.58	2.3	1.9	3.8	1.7
Inflation						
CPI (annual percent)	10.9	9.2	10.4	12.1	12.7	11.1

Source: World bank (WDI, 2009)

2.2.2 Exchange Rate Regimes of EAC Members

Intra-regional exchange rate stability is a desirable condition to form a monetary union in the East African Community. Table 2.2 below displays the average annual exchange rates (expressed in units of local currency per US dollar) of the five members of the East African Community. According to the table, in the year 1996 (i.e. pre-EAC treaty formation), the rates of currency movements were quite disparate among the EAC members; but after the establishment of the EAC treaty, the region had enjoyed stable exchange rates. For example, in the year 2010 all five members of the EAC had a single digit currency depreciation rate. This year however, Tanzania had the most depreciated currency in the region with 8.5% depreciation against the US dollar, followed by Uganda which showed a depreciation rate of 7.3 percent. Burundi, Kenya and Rwanda had enjoyed relative currency stability with a depreciation rate of 0.1, 2.3 and 2.6 percent, respectively.

Table 2-2: EAC nominal exchange rates and currency depreciation rates

	Average nominal exchange rates (per US dollar)			Yearly currency depreciation (%)	
	2008	2009	**2010**	**1996**	**2010**
Burundi	1,185.7	1230.1	1230.8	21.2	0.1
Tanzania	1,206.3	1319.9	1432.3	0.9	8.5
Uganda	1,720.4	2030.3	2177.5	8.0	7.3
Kenya	68.3	77.3	79.1	11.1	2.3
Rwanda	547.6	568.3	583.1	17.0	2.6

Source: Partner States

Exchange rate mechanisms play very important role in adjusting economic disturbances of a region; but it is less effective when factors of production (i.e. labor or capital) are moving freely in that region. For example, if wages can adjust freely and capital or labour can re-allocate without restrictions, the need for exchange rate adjustments in response to economic shocks is reduced (Kenen, 1969). In addition, countries with highly open economies are likely to experience a larger impact from exchange rate changes, and hence produce large fluctuations in internal prices. As such, the flexibility of exchange rates would become less effective as a control device for external balance and could be more damaging to internal price level stability (Ling, 2001). On the other hand, fixed exchange rate area is best served when the degree of output and factor trade is high among supposed members of currency area.

Exchange rate volatility is a major risk for business and investment; it also undermines the formation of monetary union which requires a harmony in exchange rate movements and cooperation between potential members of a currency area. In order to achieve the full benefits of a monetary union, EAC countries should build a strong foreign exchange reserves to empower their monetary authorities to maintain exchange rates within an acceptable band. Also, EAC countries should emphasize the importance of financial sector on the real economy, as financial institutions ensure economic stability which

minimises the costs & risks of production and services in the region (Herring & Santomero, 1992). A strong and integrated financial sector plays a big role in a successful monetary union as it can help ensure smooth adjustment in the members of the monetary union (Van Rompuy, 2012).

2.2.3 Political and Economic System

In this section, we have made several comparisons between political and economic systems of a few selected European Union members and members of the East African Community. As the economic theory proposes, countries with similar political & economic systems that cooperate with each other can form a monetary union more easily compared to those with different economic and political systems. According to the literature, all member countries of the European Union have established democratic societies and free market economies before they join/form the Union, while on the other hand, East African countries have relatively different political and economic systems ranging from free democracy to authoritarian regimes and from free market economy to centrally planned command economy.

Table 2.3 below shows the freedom rating assessment of the East African Countries, as prepared by the Freedom House assessment (2010). The freedom index consists of a set of questions that contain civil liberties and political rights which are taken from the Universal Declaration of Human rights. These questions are coded into a scale ranging from 1 (representing the best degree of freedom) to 7 (representing the worst degree of freedom). Then, to find the overall status of political rights and civil liberties, it further transformed into a three-point scale of “free,” “parity free,” or “not free.”

Table 2-3: Freedom rating of EAC countries, 2010

Country	Political Rights	Civil Liberties	Freedom Rating
Uganda	5	4	Partly Free
Rwanda	6	5	Not Free
Tanzania	4	3	Partly Free
Burundi	4	5	Partly free
Kenya	4	4	Partly Free

Source: Freedom House (2010)

As shown in the table above, the people of Burundi, Kenya, Tanzania and Uganda live in "partly free societies" that give them a certain degree of civil liberty and political rights, and only Rwandan people are classified as "not free." Therefore, we can conclude that countries in the East African Community region have almost similar political systems. In addition, in the last decade, there had been a positive political development in the East African Community member countries. Some of these countries were able to held multiparty elections through democratic processes. To foster and strengthen peace and stability in the region, partner states of the EAC region have signed the Great Lakes Initiatives whose objective, among others, is to ensure peace in the Great Lakes region (EAC, 2006).

Table 2-4: Index of economic freedom & competitiveness of EAC countries, 2011

Country	Economic Freedom			Competitiveness Index	
	Rank	Score (%)	Classification	Rank	Score (%)
Rwanda	75	62.7	Moderately free	66	4.2[1]
Uganda	80	61.7	Moderately free	129	3.4[4]
Tanzania	108	57.0	Mostly un-free	125	3.5[3]
Burundi	148	49.6	Repressed	146	2.9[5]
Kenya	106	57.4	Mostly un-free	96	3.8[2]

Source: The Heritage Foundation of Wall Street Journal (2011)
Note: The meaning of the scores is as follows: 0 to 49.9: repressed, 50 to 59.9: mostly un-free, 60 to 69.9: moderately free, 70 to 79.9: mostly free, 80 to 100: free.

According to the economic freedom classification, East African countries have relatively less varied economic freedom indexes, as shown in Table 2.4. Similar to the freedom rating index, the *Index of Economic Freedom* is prepared by the Heritage Foundation/Wall Street Journal and they listed a total 157 countries according to their economic freedom index. Rwanda ranks 75th in the world economic freedom index, Uganda is second and ranked at the 80th position, while Kenya and Tanzania were very close in their ranking which is 106th and 108th respectively. Burundi was ranked 148th. In other words, the economies of Rwanda and Uganda were classified as 'moderately free', Kenya and Tanzania were classified as 'mostly un-free' and the Burundian economy was classified as 'repressed.' Economic differences might be of greater concern for monetary integration than differences in political systems (Volz & Hamada, 2010). The following section provides a guideline to analyze the potential of the EAC monetary union. It evaluates whether EAC countries satisfy the preconditions for an optimum currency area.

2.3 Evaluation of EAC in the Light of Traditional OCA

The traditional OCA theory lays out several preconditions that countries forming a monetary union should satisfy in order to become an optimum currency area. This section verifies whether the EAC countries meet the preconditions based on the traditional theory of OCA; this shall be discussed in detail in the next chapter. Whenever possible, we compare how the EAC regional trade block fits the OCA criteria relative to other such existing monetary unions such as the EMU. It covers the following subtopics: 1) the degree of openness; 2) factor mobility; 3) similarity of production structure; 4) macroeconomic convergence; 5) intra-industry trade intensity; and 6) diversification of production.

2.3.1 Degree of Openness

The openness of the economy criterion was one of the earliest traditional OCA requirements; McKinnon (1963) suggested that the more open an economy is; the larger the benefits and the smaller the costs of joining a monetary union, if other things held constant (McKinnon, 1963). Economic openness removes trade barriers and increases economic growth and employment in the region which consequently enhances its economic welfare. According to McKinnon (1963), the nominal exchange rate is ineffective to be used as a policy tool for adjustment when the economy of a region is open. Therefore, it is easier to join a monetary union when the economy of the region is more open. The degree of openness is conventionally determined by the proportion of trade to the Gross Domestic Product (GDP).

Table 2.5 and 2.6 display the data of the openness measures for the EAC and EMU countries. In 2008, Burundi had the highest degree of openness relative to the other EAC members, while Rwanda had the least open economy. We computed the overall openness for both the EAC and EMU as the percentage of sum of the total trade (exports and imports) of the member countries to the sum of their gross domestic product. The comparison of the degree of openness between the EAC and EMU showed that EAC is less open on average than the EMU. The degree of openness for the EAC averaged 58.57% in 2008, while the degree for the EMU averaged 76.00% in 2000[1]. On average, the degree of openness of the EAC region is increasing across the time; for example, in 2000 the openness rate of EAC was 36.44% whereas in 2008 it averaged to nearly 59%.

[1] The data of EMU before they implemented Euro (1995-2000) was used as a comparison.

Table 2-5: EAC trade openness (total trade as a % of GDP)

Country	2000	2005	2000-2004	2008	2006-09 Latest
EAC Average	36.4	49.6	40.7	58.6	54.5
Burundi	28.7	52.1	33.7	67.7	61.1
Kenya	51.5	64.3	54.4	64.4	60.4
Rwanda	31.8	38.5	34.1	40.7	33.1
Tanzania	36.8	50.6	44.2	61.9	57.6
Uganda	33.5	42.3	37.2	58.2	60.3

Source: World Bank (2011), World Trade Indicators 2009/2010, On-line.

Table 2-6: EMU trade openness (total trade as a percentage of GDP)

Country	1995	1996	1997	1998	2000
EMU 5 Average	62.9	63.1	67.2	67. 6	76.0
Finland	65.6	67.0	69.5	68.1	77.0
France	44.4	44.5	48.5	49.9	55.7
Germany	47.1	48.7	53.5	55.8	66.0
Italy	48.5	45.5	47.6	47.7	53.2
Netherlands	109.3	110.0	116.9	116.4	128.1

Source: World Bank (2011), World Trade Indicators 2009/2010, On-line.

2.3.2 Factor Mobility

Factor mobility is the degree of movement of production factors among countries. Mundel (1961), the father of the OCA theory, proposed that the flexibility and mobility of production factors (such as labour and capital) are key prerequisites for a monetary union. For example, if an economic shock hit in one of two countries that are well integrated in the sense that their capital and labour are moving freely in the domain of those two countries, then there would be less need to use exchange rate as a tool to correct the economies (Laabas & Limam, 2002). According to Mundel, countries with highly integrated factors of production are better candidates to form a monetary union compared to those with less integrated factors of production, and he believed that factor mobility can play a role as a replacement for the exchange rate mechanism as a corrective mechanism in times of economic shocks.

We used real capital and labour as substitutes for factors of production. For example, when real capital is moving freely across a region, it means that the capital moves from low capital productivity countries to goes to high capital productivity countries, this reduces the need for asymmetric policy responses to asymmetric shocks in the region. Based on this argument, we examined the extent to which real capital can freely shift in and out of the East African countries. For this purpose, we investigated the degrees of intra-movement of the foreign direct investment (FDI) in the East African community; if the inward and outward FDI movement of the region is too low, then the EAC member countries would need country-specific policy responses towards the asymmetric shocks. This indicates that forming a monetary union in the region is impossible. Therefore, to achieve the target, EAC countries would have to increase the mobility of production factors in the region.

Table 2-7: Inward and outward FDI stocks as a percentage of GDP, 2004-2008

		2004	2005	2006	2007	2008
Burundi	Inward	0.006726	0.073466	0.003439	0.051057	0.327933
	Outward	0.00	0.00	0.00	0.003575	0.049749
Kenya	Inward	0.286181	0.113202	0.225199	2.683624	0.318286
	Outward	0.027436	0.051699	0.106468	0.132637	0.145736
Rwanda	Inward	0.388526	0.336053	0.396297	1.967954	2.318897
	Outward	0.00	0.00	-0.50591	-0.37945	0.00
Tanzania	Inward	2.912409	3.493514	4.165378	3.845172	1.926813
	Outward	0.00	0.00	0.00	0.00	0.00
Uganda	Inward	3.488247	4.220091	6.493157	6.662301	5.047243
	Outward	0.00	0.00	0.00	0.00	0.00

Source: World Bank (2011), World Development Indicators, On-line.

Table 2.7 shows the inward and outward FDI stocks as a percentage of GDP. The FDI inflows/outflows to and from the East African countries were recorded at a very low rate. This is due to the experience of the earlier EAC in 1967; in that period, member countries adopted conflicting political and economic ideologies and exchange controls were imposed to restrict capital flight following nationalization policies in Uganda and Tanzania. But in mid 2010, partner states had implemented a common market protocol that allows the factors of production (i.e. labour and capital) to move freely across national borders within the community. Table 2.7 shows that in 2008, Uganda had the largest FDI inflows of the region; Burundi was ranked second highest while Rwanda had the smallest share of FDI inflows. Overall, in terms of FDI outflows, Kenya is leading in the region.

2.3.3 Similarity of Production Structure

Countries with similar production structure are more likely to display high co-variation in economic activities and experience symmetric shocks since differences in structures could make one country in a monetary union more vulnerable to shocks that do not affect the rest of the member countries. Such countries are better candidates to form a currency union as they are no longer need to use exchange rate as an adjustment tool. This subsection is about the similarity of economic structures in the region.

Table 2.8 exhibits data on the value added by the principal sectors as a share of each country's GDP. It illustrates that in general terms, the structure of the East African economies is similar, with agriculture contributing a large part of GDP and exports. The percentages of contribution by the agricultural sector are 20.54%, 28.39%, 26.56%, 35.83% and 29.8% for Uganda, Tanzania, Kenya, Rwanda and Burundi respectively. Dependency on the agricultural sector in the region is declining year after year. Kenya

and Tanzania have a relatively larger manufacturing sector and export more manufactures. Wholesale & retail as well as transport & communication are also considerable sectors of the EAC economy. The financial intermediation of the region is not well-developed and it represents a small portion of the GDP of the region.

Real estate, renting and services are of great importance to Tanzania, generating 11% of its GDP in this sector, as well as to Rwanda where they generate 10% of its GDP. In summary, the EAC region is dominated by primary and agricultural products, as characterized by the majority of African countries. Similarities in production would also suggest similarities in economic shocks and business cycles, and this will ultimately necessitate common policy reaction among the EAC members. Hence, the establishment of a monetary union is seen as feasible.

Table 2-8: Components of the EAC GDP

	Burundi			Kenya			Rwanda			Tanzania			Uganda		
	2002	2007	2008	2002	2007	2008	2002	2007	2008	2002	2007	2008	2002	2007	2008
Agriculture & Forestry	39	34.5	29.8	28	25.63	26.56	35	36.26	35.83	23	28.51	28.39	22	19.6	20.54
Fishing	-	-	-	1	0.45	0.4	-	2.28	0.38	2	1.46	1.32	2	2.92	2.84
Mining & Quarrying	12	7.92	7.78	1	0.8	0.79	-	1.2	1.04	3	3.91	3.74	-	0.31	0.31
Manufacturing	-	-	-	11	11.02	12.06	7	5.93	6.93	11	8.56	8.62	8	7.54	7.81
Electricity & Water Supply	-	-	-	2	1.75	1.66	1	0.74	0.21	3	2.22	2.29	4	4.95	4.5
Construction	4	3.77	3.64	3	4.32	4.33	6	7.45	8.22	8	8.65	8.48	12	13.25	13.29
Wholesale & retail	34	8.36	27.89	10	11.01	11.38	10	10.55	12.66	16	12.73	12.81	14	15.33	15.59
Hotels & Restaurant	-	-	-	11	1.85	1.28	1	0.99	2.46	3	2.95	2.89	5	4.45	4.48
Transport & Communication	-	-	-	11	12.93	11.61	6	6.5	7.67	8	7.24	7.34	5	6.87	7.48
Financial Intermediation	-	-	-	4	5.29	5.33	3	-	2.71	2	1.82	1.8	2	3.19	3.44
Real Estate, renting & Serv.	-	-	-	11	6.18	5.79	10	15.74	10.04	8	10.44	10.59	10	9.35	8.87
Others	89	54.55	69.11	93	81.23	81.19	79	87.64	88.15	87	88.49	88.27	84	87.76	89.15

Source: EAC Statistic Indicators: Economy and Finance, on-line 2011.

2.3.4 Macroeconomic Convergence Criteria

At the end of 2007, the Monetary Affairs Committee (MAC) of EAC, which comprises of Central Bank Governors, met in Entebbe, Uganda to develop the road map and strategic frameworks through which the EAC can fast track the establishment of a monetary union in 2015. They had agreed on the following particular macroeconomic convergence criteria: reduction in inflation rates (≤ 5%), debt reduction including grants (≤ 5%), high economic growth of real GDP (≥ 7%), increased domestic savings to GDP ratio (≥ 20%), building up of reserves, increased fiscal discipline and a lower ratio of current account deficits (EAC Development Strategy 2001-2005). These macro-economic convergence criteria would remove all macro-economic disharmonies which may exist among the EAC member states as a result of pursuing divergent macro-economic policies.

Tables 2.9 through 2.13 provide information on the macroeconomic convergence of the East African countries. Tables 2.9 & 2.10 show the monetary convergence criteria, while the other three show fiscal convergence. As shown in Table 2.8, real GDP growth of the EAC countries are less than the growth target; Uganda, Tanzania and Rwanda have higher GDP growth rates compared to the GDP growth rates for Burundi and Kenya.

Table 2-9: EAC macroeconomic convergence criteria RGDP growth target ≥ 7%

Countries	2005	2006	2007	2008	2009	2010
Burundi	0.91	5.2	3.6	4.5	3.5	3.8
Kenya	5.9	6.3	6. 9	1.3	2.4	4.1
Rwanda	9.3	9.3	5.5	11. 2	4.1	5.4
Tanzania	7.4	6.8	7.1	7.4	6.0	6.5
Uganda	6.3	10.8	8.4	8.8	7.2	5.8

Source: IMF, World Economic Outlook, on-line 2011.

Table 2.10 shows that there was a certain degree of inflation convergence in the past two years. According to the table, over the last five years, the East African countries have managed to reduce inflation into single digits (or close) from relatively high double digits in the earlier years. For example, Burundi had significantly reduced inflation from approximately 24% in 2008 to single digits (7%) in 2010, which can be considered as a remarkable achievement. Nevertheless, EAC partner states need to exert more effort to achieve their stated goal of less than 5% inflation rate.

Table 2-10: EAC macroeconomic convergence criteria, inflation rate target ≤ 5%

Inflation	2005	2006	2007	2008	2009	2010
Burundi	13.5	2.7	8.3	24.4	10.7	7.2
Kenya	9.9	6.0	4.3	16.2	9.3	4.1
Rwanda	9.1	8.8	9. 1	15.4	10.4	6.4
Tanzania	4.4	7.2	7.0	10.3	12.1	7.2
Uganda	7.9	6.6	6.8	7.3	14.2	9.4

Source: IMF, World Economic Outlook, on-line 2011.

Concerning the domestic savings of the East African countries, it seems that it is far away from the savings target of 20% or greater. All EAC countries had single digit domestic savings except Uganda which had domestic savings of 15.28% and 12.52% in the years 2008 and 2009 respectively. Burundi had negative domestic savings in the years 2005 and 2006. This causes problems to the EAC long-term convergences. To achieve a GDP savings rate of 20% and above, EAC member countries should implement harmonization policies and measures towards achieving this goal.

Table 2-11: Macroeconomic convergence criteria, savings % of GDP ≥20%

	2005	2006	2007	2008	2009
Burundi	-23.12%	-19.87%			
Kenya	9.45%	8.06%	8.04%	6.12%	7.81%
Rwanda	5.17%	2.55%	3.03%	7.78%	4.53%
Tanzania	9.70%	10.73%			
Uganda	11.74%	8.06%	8.76%	15.28%	12.52%

Source: World Bank (2011), World Development Indicators, On-line.

Table 2.12 shows that Uganda, Rwanda and Burundi have comparatively low budget deficits of less than 5% of GDP when the deficit is defined to include grants, while Kenya and Tanzania still have budget deficits greater than 5% of GDP. However, when grants are excluded from the budget, all EAC countries have a bigger budget deficit which is greater than 5%. In general, Uganda had a moderately lower budget deficit compared to other EAC members. Thus, we may conclude that EAC countries need to lower their deficits. In summary, although EAC countries have made some progress towards macroeconomic convergence, they still need to strengthen their convergence before implementing a single currency in the region.

Table 2-12: EAC budget deficit including grants ≤ 5%

	2005	2006	2007	2008	2009
Burundi	6.1%	2. 6%	3.4%	0.0%	4.1%
Kenya	7.2%	9.2%	7.7%	18.6%	9.8%
Rwanda	0.3%	0.4%	0.3%	1.8%	5.9%
Tanzania	6.0%	8.4%	3.6%	5.9%	14.9%
Uganda	0.8%	2.6%	2.5%	2.8%	1.2%

Source: World Bank (2011), World Development Indicators, On-line.

Table 2-13: EAC, budget deficit excluding grants ≤ 5%

	21.66%	16.07%	14.93%	3.26%	17.93%
Burundi	8.6%	11.0%	9.1%	20.9%	17.2%
Kenya	14.7%	17.3%	17.4%	22.2%	13.3%
Rwanda	13.6%	15.7%	12.3%	13.3%	19.7%
Tanzania	10.5%	8.5%	10.5%	6.7%	10.3%
Uganda	21.7%	16.1%	14.9%	3.3%	17.9%

Source: World Bank (2011), World Development Indicators, On-line.

2.3.5 Intra-EAC Trade Intensity

There are many reasons behind the establishment of a monetary union in a region, and one of them is to generate economic benefits from the reduction of transaction costs attained by the formation of MU. This is because the stronger the intra-regional trade among EAC members, the smaller the costs and larger the benefits of forming a currency union will be, ceteris paribus (AlKholifey & Alreshan, 2009). More intra-trade volume across the EAC members would strengthen the economic similarities of the region. Hence, the business cycle will be synchronized and consequently the cost of creating the common currency will be reduced. In 2008, the total EAC trade with the rest of the world increased by 29.6 percent (US$ 34,672.1 million) compared to an increase of 25.4 percent in 2007 (US$ 26,745.3 million). In terms of intra-EAC trade share to total trade, EAC countries traded a total amount of US$ 3,766.5 million. Figure 2.2 shows the intra-EAC trade from 2000 to 2008. As can be seen from the figure, the intra-EAC trade shows an increasing trend, where it increased from US$ 1,201.7 million to $ 3766.479 million.

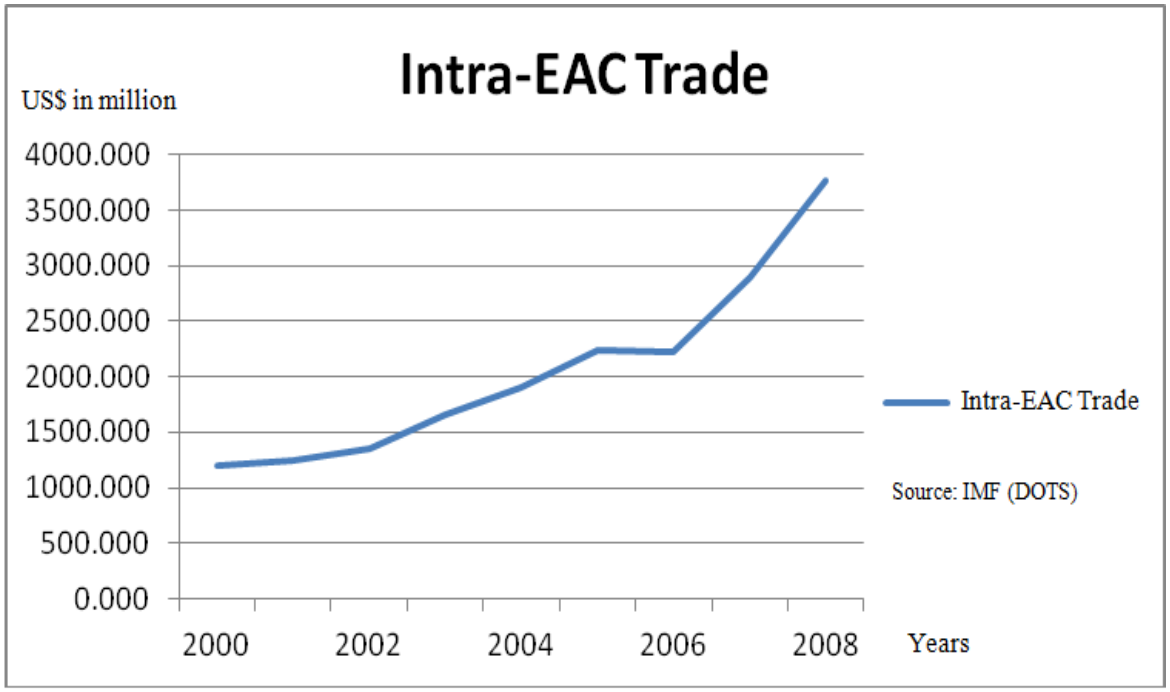


Figure 2-2: Intra-EAC trade from 2000-2008

Table 2.14 shows the share of intra-exports within the EAC during the year 2009, and as shown in the table, intra-regional trade of EAC is significant. For example, the EA region absorbed 29% of Uganda's exports, with Kenya being the single most important destination for its goods. Tanzania was the second largest exporter within the region; 27% of Tanzanian exports went to EAC member countries. Rwanda and Kenya are the third and fourth exporter, each exporting 20% and 19%, respectively.

Table 2-14: Intra-EAC exports as share of total exports, 2009

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	--	0.1%	0.2%	0.0%	0.1%
Kenya	1.5%	--	9.3%	25.2%	25.9%
Rwanda	0.4%	7.1%	--	0.1%	0.4%
Tanzania	0.9%	2.6%	2.7%	--	2.8%
Uganda	2.5%	9.1%	7.6%	1.7%	--
EAC	**5%**	**19%**	**20%**	**27%**	**29%**

Source: International Monetary Fund (Direction of Trade Statistics – DOTS).

Table 2.15 exhibits the share of intra-imports within the EAC during the year 2009. As shown in the table, Kenya was the largest importer within the region; 62% of Kenyan imports are from the EAC countries, mainly Uganda (26%) and Tanzania (25%). Uganda and Tanzania have substantially imported from East Africa, particularly from Kenya. On the other hand, Burundi's imports are less dependent on the EAC member countries. To maximize the potential benefits accrued from the formation of the EAC monetary union, member countries of this community should further improve their intra-trade activities.

Table 2-15: Intra-EAC imports as share of total imports, 2009

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	--	1.5%	0.2%	0.9%	1.75%
Kenya	0.1%	--	7.1%	2.6%	9.2%
Rwanda	0.3%	9.3%	--	2.7%	8.4%
Tanzania	0.0%	25.3%	0.1%	--	1.7%
Uganda	0.1%	25.9%	0.2%	2.8%	--
EAC	**0.4%**	**62.1%**	**7. 5%**	**9.0%**	**21.0%**

Source: International Monetary Fund (Direction of Trade Statistics – DOTS).

Figure 2.3 displays the percentage of intra-EAC trade to the world trade for the period of 2005-2009. The table indicates that the share of intra-EAC trade in the total trade was quite big, with a minimum of 7% and a maximum of 38%. Rwanda showed high intra-regional trade. Higher intra-trade indicates that the potential gain from trades caused by the introduction of a common currency will be bigger. Intra-regional trade is very important in forming a monetary union as the endogeneity of the OCA theory argues that countries with high levels of intra-trade would become more integrated after forming a monetary union despite being unsatisfied with some of the OCA criteria.

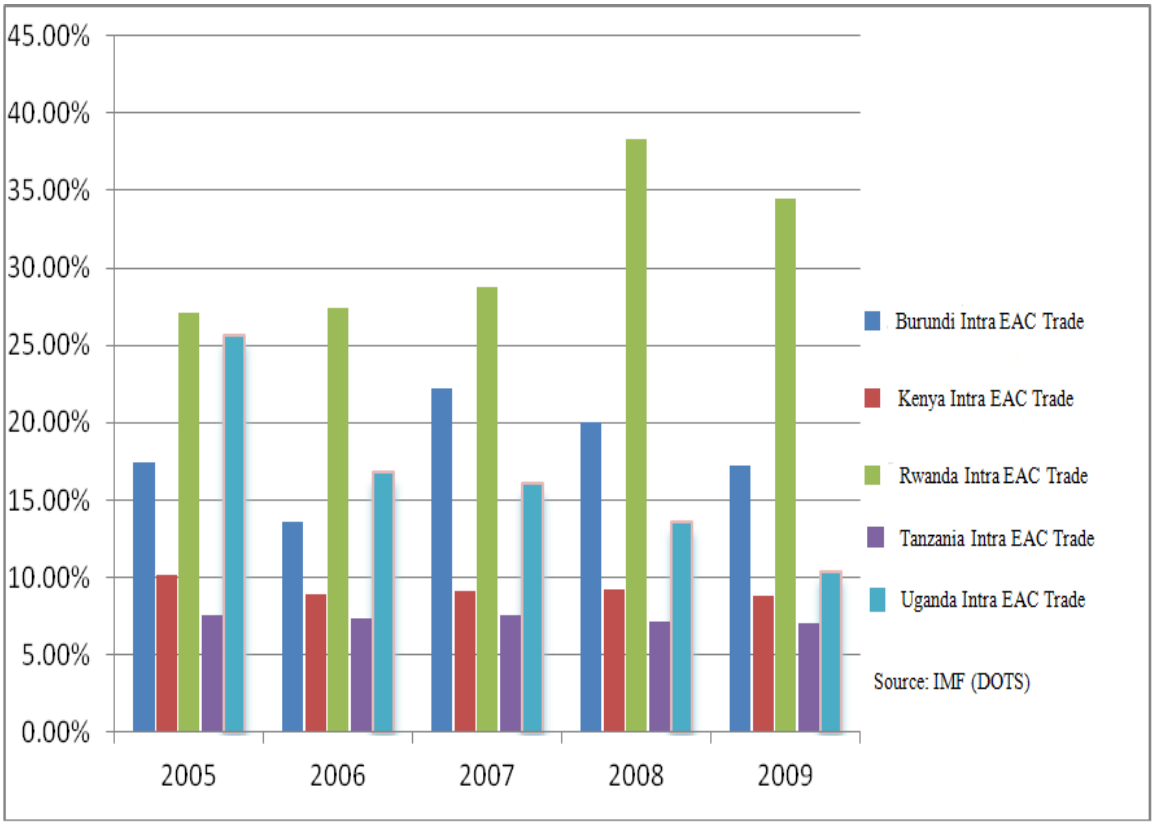


Figure 2-3: Percentage of intra-EAC trade to world trade for selected years

2.3.6 Diversification of Production

Economic diversification protects countries from a variety of shocks and thus minimizes the need to use the exchange rate as a tool to reduce the impact of the disturbance. Thus, countries with diversified economies are better candidates for a monetary union compared to those whose economies are less diverse. This argument is proposed by Kenen (1969). Table 2.16 shows the standardized Hirschman export concentration index for the EAC members, together with a comparable group selected from the EMU. In order for an economy to be more diversified, Hirschman export concentration index must be low. According to the table, EAC countries have higher export concentration compared to some of the selected EMU countries; thus, EAC economies are seen as less diversified, indicating that these countries are vulnerable to external shocks.

Table 2-16: Export concentration indices for EAC countries

Countries	2000	2006	2007	2008	2009
Tanzania	0.3	0.3	0.3	0.2	0.3
Uganda	0.3	0.3	0.2	0.2	0.2
Kenya	0.3	0.2	0.2	0.2	0.2
Burundi	0.7	0.3	0.4	0.4	0.6
Rwanda	0.5	0.5	0.5	0.4	0.4
Finland	0.2	0.2	0.2	0.2	0.1
France	0.1	0.1	0.1	0.1	0.1
Germany	0.1	0.1	0.1	0.1	0.1
Italy	0.1	0.1	0.1	0.1	0.1
Netherlands	0.1	0.1	0.1	0.2	0.1

Source: UNCTAD Handbook of Statistics on-line (2011)

2.4 Concluding Remarks

This chapter reviews the social and economic background of the five countries in the East African Community. Using the traditional OCA criteria, we assessed whether or not the East African Community is an optimum currency area. Using the available data and information, we assessed seven OCA criteria in the context of EAC countries. EAC had met four out of seven OCA criteria, namely political will, openness, intra-regional trade intensity, and similarity of production structure. Thus, these criteria indicate that the EAC countries are not adequate enough to qualify as good candidates for an optimum currency area. The three unmet criteria are factor mobility, macroeconomic convergence and diversification of product. In conclusion, although the EAC has satisfied some of the major traditional OCA criteria there are still criteria that remain unfulfilled and therefore it is essential for the EA economies to continue with their efforts of achieving more economic convergence.

CHAPTER 3

THEORY OF MONETARY INTEGRATION

AND LITERATURE REVIEW

3.1 Introduction

This chapter reviews the theoretical foundations of the theory of "optimal currency area" and its related empirical studies. Understanding the concept of Optimum Currency Area is very important in understanding the meaning of Monetary Integration. Monetary integration has no generally accepted definition but it involves the irreversibly fixing of the exchange rates, total exchangeability of currencies and a common monetary policy. This chapter is organized as follows. Starting with the theoretical developments of OCA from early 1960s up to date would be presented. The theoretical literature review is useful to understand the development of the OCA theory from the traditional theory to the so-called new theory of OCA which questions many of the conclusions of the "old" theory.

The second section presents the benefits and costs of joining Monetary Union. Section three of this chapter provides the key methodologies of testing OCA criteria, with particular emphasis on the models used in this study. Section four gives a review of empirical studies of business cycle synchronization and structural vector auto-regression with specific reference to East African Community region. The last section is about critiques against earlier studies of monetary union in EAC.

3.2 Theoretical Background of Optimum Currency Area (OCA)

The optimum currency area theory (OCA) is an instrument used to answer the question of how to choose the optimum exchange rate regime in a geographical region; it discovers the criteria as well as the benefits and costs of establishing a monetary union in block (Broz, 2005; Kamaludin Ahmed Sheikh et al., 2013). Meanwhile, there is no standard theory of OCA and a widely accepted rule or index to indicate clearly 'the benefits and costs of joining a country in to a currency area'; instead there are different Approaches of assessing feasibility of monetary union in a region. These approaches are divided into two main parts, the "Traditional OCA Theory" and the so called "New OCA Theory".

3.1.1 Traditional OCA Theory

The debate on OCA theory had started in early 1960s and since then huge literature of it had formed. Traditional OCA theory was founded by Robert Mundell through his seminal paper titled 'A Theory of Optimum Currency Areas' (1961), followed by Ronald Mckinnon (1963), Kenen (1969), Corden (1972), and Ishiyama (1975); these authors are the founders of the traditional Optimum Currency Area Theory (OCA). The traditional OCA theory describes the characteristics that potential monetary union members should possess before they form common currency and surrender their national monetary policy and exchange-rate adjustment of their national currencies (Kamaludin Ahmed Sheikh, et al., 2013).

Robert Mundell (1961) was the first economist who discovered this branch of economics; he proposed that common currency can be used in a regional area regardless of national borders of states. In his seminal paper, he highlighted the conditions that a group of countries would successfully form a monetary union area and the conditions that they should retain their independent monetary. The implication of Mundell's paper was that currency boundaries and political borders should not always concur. Mundell (1961) emphasised that it is an important prerequisite for monetary union area to have a freely moving and flexible factors of production. This freely movement of factors of production (i.e. labor, wages, or capital) in currency area can replace the need for exchange rate adjustments in economic disturbances. This means countries with high mobile factors of production are better candidates for a currency union, as factors of production would tend to move from the deficit country to the surplus country (Alturki, 2007). In other words, if wages can adjust freely and capital or labour can re-allocate without restrictions, the requirement for exchange rate adjustments in response to economic shocks is reduced.

Mundell (1961) also proposes that when supply and demand shocks in a region are symmetric, then common currency is appropriate; but when the supply and demand shocks are asymmetric then common currency is not appropriate, in this case equilibrium is either restored through exchange rate adjustment or through high labour mobility or wage flexibility. This argument of assessing the extent of asymmetries between regions is one of the widely used OCA approaches that assess the cost benefit analysis of common currency. Although, OCA theory is used to predict the optimum currency area that should be adopted in a region; yet, it do not always give a single quantifiable criterion that would lead to unambiguous strategies of monetary unification (Willett, T. D., 2001).

In a later paper, Mundell (1973) has revised his earlier presumption of optimum currency area; in this paper he argues that although symmetric shocks are desirable, but they are no more-strong precondition of currency union. To be good candidates for currency area, he proposed to promote portfolio diversification for international risk sharing (Broz, 2005). For example, based on the risk sharing properties within a currency area, countries that are subject to asymmetric shocks are not hit by severe asymmetric shock because these countries share portfolio diversification in capital markets (Ling, 2001). This is an important assumption because financial capital moves much more easily than physical capital and labor (Broz, 2005; McKinnon, 2004). The first seminal paper of Mundell (1961) is known as Mundell I (Stationary Expectations Model) while the second paper of Mundell (1973) is known as Mundell II (International Risk-sharing Model); in addition, the classical article of Mundell (1961) is more cited and popular among the economist than the later paper of Mundell (1973).

McKinnon (1963) extended the OCA theory by adding one more condition of degree of openness in international economies. He argues that the higher the degree of openness in a group of countries, the more changes of having successful common currency in a region; this means countries that are open to each other in trading goods and services usually have fixed exchange rates and in result they can effectively utilize the formation monetary union. McKinnon also suggested that the size of a geographical area can determine the optimality of exchange rate regime in a bloc; this means small geographic areas are likely to be relatively open, while large geographic areas are less likely to be open, in other words, small open economies are more likely to join monetary union rather than close economies.

Several years later, Kenen (1969) had added another important criterion which is diversification of production. Kenen suggested that more diversified economies are favourable of making optimum currency area; because it is better protected against different types of shocks and hence is less prone to use the exchange rate as a tool to reduce the impact of economic disturbances. Hence they bear small cost from neglecting exchange rate changes amongst them and find a single currency beneficial (Böwer, 2006). Kenen emphasized that diversification of production in bloc can play a big role in maintaining internal stability of prices; hence the need of exchange rate as an adjustment mechanism is omitted. Kenen also highlighted that fiscal and monetary policies are important indicators of policy coordination which is required for the success of monetary integration (Kenen, 1969). For example, fiscal policy integration would allow countries of a monetary union to redistribute funds to a member country affected by an adverse country-specific disturbance. In summary, similarity of policy instruments is an important indicator for the potential success of monetary integration.

Ishiyama (1975) is the first scholar who had identified that there is no one single criterion in identifying optimum currency area, instead there are a set characteristics that candidate countries should possess; he also pointed out that it is the self-interest of particular country to evaluate the benefits and costs of joining in a currency union. Ishiyama (1975) had contributed two more characteristics to consider for the traditional OCA theory; inflation differential and wage flexibility. He indicated that candidate countries of common currency should possess inflation and wage stability as this would signal similarity in economic structure and policies (Broz, 2005).

Furthermore, Krugman (1993) and Mongelli (2002) extended the traditional OCA criteria by proposing that successful monetary integration would depend on the political will and interregional compensation schemes of member countries in order to achieve successful and efficient monetary union. The most important prerequisite of successful of currency union is the political will of member countries to achieve the goal of currency union. As we had discussed in the above chapter, the Old EAC (1967-1977) had collapsed because of lack of political will and different political ideologies; therefore, political factors are be more important than the economic criteria. Frankel (1998) had listed a set of prerequisite OCA criteria which prospective country should possess before entering single currency area. He proposed the following points: neighbouring country of monetary union candidates should have close integration with their trading partner, should have access to an adequate level of reserves, should have import stability, they should have strong, well-supervised and regulated financial system, and finally, the rule of law should prevail in the bloc.

The above mentioned OCA criteria laid by the traditional OCA literature did not answer well about the question of 'what is the appropriate domain of a currency are?', instead it gave ambiguous indications about the formation of currency union; for example when will a currency union be most beneficial, or when will the loss of giving up national monetary and exchange rate policies be less harming. In addition to that, several of traditional OCA properties lack a unifying analytical framework; and they are criticized for being contradicting and inconclusive (Robson, 1998; Tavlas, 1994).

The first limitation of traditional OCA criteria is that it cannot be measured, ranked, or evaluated against each other. This means some of traditional OCA properties may seem to be inconsistent to each other and point in different directions. For instance, a country with low mobility of factors of production could be quite open in international trade as well as intraregional trade of reciprocal trade with partner countries. In other words, if one OCA property suggests to a candidate country to engage in a currency union or to have a fixed exchange rate regime with main trading partners; on the other hand, another OCA property would suggest the country not to join a currency union. The second limitation is that OCA properties could give contradictory conclusions when analyzing a particular type of economy. For example, while a small economy tends to be open, it also could be characterized as less diversified in production. Thus according to one OCA property, this economy should adopt a fixed exchange rate with its main trading partners. However, according to the diversification of production property, this economy would be a better candidate for a flexible exchange rate.

Traditional OCA theory laid the theoretical foundations of optimum currency areas; it describes the characteristics the potential monetary union members should possess before they form common currency and surrender their national monetary policy and exchange-rate adjustment of their national currencies. The traditional OCA theory emphasizes on the costs associated with the formation of a monetary union (the cost of the losing national monetary policy and the cost of losing of exchange rate as adjustment tool). Traditional OCA theories did not consider the positive effects resulting from creation of currency union; as the formation of currency area would result economies to become stronger and fulfil the suggested properties of traditional OCA theory. As a result, the critics and failures of traditional OCA theory had triggered many of the new theoretical modelling of OCA that began to emerge in the 1990s, these new theoretical modelling consider both the benefits & costs of forming monetary areas.

To sum up, traditional OCA theory had proposed a set condition that should be fulfilled before the formation of currency union. The following points are the main properties proposed by traditional OCA theory: diversification of production, openness, factor mobility, similarity of production structure, price & wage flexibility, similarity of inflation rates, fiscal and political integration, size of an economy, financial market integration and many others (Alturki, 2007).

3.1.2 New OCA Theory

The inherited inconsistencies and contradictions of Traditional OCA theory had attracted the interest of many researchers and policy makers; leading to reconsider the theory especially the cost-benefit analysis and the stability of OCA criteria (Broz, 2005). New OCA theory is primarily concerned with potential benefits rather than costs. This theory questioned the validity of some traditional OCA properties. First, the experience of many developed countries in the 1970s & 1980s of high inflation with increasing unemployment questioned the effectiveness of national monetary policy. Second, the time inconsistency literature shows that a high inflation country can join a currency union with the objective of price stability without high cost of adjustments. Third, the use of exchange rate adjustment as stabilization tool is also questioned. Finally, the endogeneity of OCA criteria suggests that non-optimum currency area can become one.

New OCA theory gives a Meta analysis form of assessment which combines a broad range of OCA properties in a group of countries; the most popular methodological analyses of the New OCA theory are “symmetry of shocks” and “synchronization of business cycles”. These two methods are the key requirements for a suitable monetary union. Proponents of the New OCA theory include: De Grauwe (1992), Tavlas (1993), Krugman (1993), Bayoumi and Eichengreen (1994), Darvas & Szapáry (2008), Kwan

& Yan(Kwan, 2009), Frankel and Rose (Frankel J. A. & Rose, 1998), etc. Most of the literature on the OCA theory outlines "symmetry of shocks" and "synchronization of business cycles". The following sub-topics would give comparative analysis of the critics of traditional OCA theory and the superiority of New OCA theory.

A) Monetary Policy Ineffectiveness

Most of the traditional OCA criteria were based on the assumption that monetary policy could be used to achieve the desired trade off between unemployment and inflation, as Phillips curve postulated lower unemployment in an economy is correlated with a higher rate of inflation. By maintaining this assumption, the cost of joining a MU requires surrendering national monetary policy would be high as each member country wouldn't be able to position his economy to the desired equilibrium of unemployment & inflation. Major implication of traditional OCA theory is that the expected costs of monetary integration are reduced.

In 1970s and 1980s many of developed countries had experienced higher inflation rate with escalating unemployment rate; this problem had triggered many questions concerning the effectiveness of monetary policy and the validity of Phillips curve in the short term. On the other hand, monetarists had stated that monetary policies are effective in controlling unemployment in the short run, but not in the long run. With the assumption of expectation formation, rational economic agents are able predict the future inflation. This would in turn lead economic agents to bargain in terms of real values rather nominal values. Consequently, in the long run Phillips curve turns into vertical as unemployment rate is related with the Natural Rate of Unemployment; and inflation rate can be determined without detrimental effects on the level of long run unemployment.

B) Inconsistency and Credibility Issues

One of the traditional OCA conditions for the formation of monetary union is that member countries of an optimum currency area should have similar of inflation rates. Contemporary theory shows the benefits from monetary integration can be increased if the inflation rates of currency area divergence and the new supranational central bank adopt a credible policy to fight inflation. For example, a country suffering with high inflation and had a history of inefficiency in controlling inflation promises would find it difficult to reduce inflation without a long and costly process of disinflation. However, this same country could attain a low inflation reputation overnight by joning itself to the control of the low inflation central bank without any loss of employment and production De Grauwe (1992) and no cost to the low inflation country Giavazzi & Giovannini (1989).

These insights have important effects on OCA theory as currency union entails a set of policy rules that "tie the hands", both in terms of exchange rate & monetary policies. An economy that had reputation of high-inflation would be able to improve its reputation when entering a monetary union that has reputation of pursuing a tight monetary policy. Thus in this scenario, the loss of exchange rate & monetary control would be weighed against a benefit of achieving lower and stable inflation rates in the short-run, while the employment levels is unchanged. The cost in giving up exchange rate policy would affect the economy's ability to manage external equilibrium. However there is also vast literature that suggests exchange rates are less effective in maintaining external balance equilibrium, as would be demonstrated next.

C) The Effectiveness of Exchange Rate Adjustments

The traditional OCA theory views the use of exchange rate as an effective adjustment tool that restores the external disequilibrium based on movements in trade flows. A new development in the asset model of exchange rate determination shows that the effects of exchange rate adjustment on the external balance involve lags that are longer than what are implied by the flow model. There are three views on this matter.

The first view states that the portfolio channel causes the exchange rates to operate in considerably slow manner. Given that domestic and foreign assets are imperfect substitutes, the portfolio balance model assumes that the current account influences exchange rates indirectly through the changes of wealth and the effect on the risk premia associated with holding foreign assets. Assuming perfect prediction, correction of current account is dependent on the changes and distribution of wealth, which, in turn, affect risk premia. In the case of imperfect prediction exchange rate movements fails to correct external imbalance. In both cases the exchange rate does not adjust instantly to correct external imbalances as implied by the traditional theory of OCA.

The second view regarding the exchange rates ineffectiveness in correcting external balance disequilibrium is derived from the concept of Ricardian equivalence and the portfolio balance model. This view states that the effects of exchange rate adjustments on external balance can be ambiguous, when changes in the real exchange rate and the current account are the outcomes of a maximization problem (Tavlas, 1993). Based on the above arguments, economists neglect the effects of exchange rate movements, as they anticipate future returns of exchange rate movements.

Finally the third view on this matter is described by the sunk costs model of industrial relations. Under the assumption of rationality, firms may not always change their export prices as quick as was thought in the trade flow model. In this model firms are found to be unwilling to react to the movements of exchange rate in the short run if this may boosts their profitability in the long run. This reduces the effectiveness of nominal exchange rate adjustments.

Furthermore, the traditional OCA theory views the elimination of exchange rate volatility as a benefit of monetary integration. This argument is based on the view that member countries of currency area are supposed to attain growth improvements and welfare gains through the reduction of exchange rate uncertainty. However, both empirical and theoretical developments of OCA question this belief, as the effect of exchange rate certainty is ambiguous and difficult to quantify. In the case of unexpected shocks, it demonstrates that exchange rate would need to exceed its equilibrium in order to compensate for rigidities in output and labour markets.

Joining a currency union or fixing exchange rate does not reduce the uncertainty risk associated with flexible rate; it rather leads to more variability in the output market (De Grauwe & Skudelny, 2000). Thus the welfare gained from fixed exchange rate in currency union, seems to be overstated by traditional OCA theory. In conclusion, the benefits and costs resulting from the loss of exchange rate policy have been diminished by the new/contemporary OCA theory and thus the traditional prerequisite of exchange rate convergence appears to be nullified.

D) Endogeneity of OCA Criteria

The old or traditional OCA theory was primarily designed to figure out the prerequisite conditions that that would enable to form a successful single currency union. If candidate members of currency union score poorly under the criteria of the traditional OCA paradigm, then they should wait before forming a monetary union. Conversely, the new OCA theory contributed by Frankel and Rose (1998) presented the OCA theory in a more prospective way, which argues many of the traditional OCA preconditions are in fact strengthened by the formation of currency union. This view states that increased economic integration boosts convergence between countries, hence, the costs of forming monetary union is reduced. The endogeneity of OCA criteria suggests that candidate members of monetary union would become more integrated after forming a monetary union, thus, a their judgement to form a currency area should not only be based on ex ante situations of independent monetary, but also they should consider ex post conditions, that allows the economic effects of monetary union (Frankel & Rose, 2002).

The contribution by Frankel and Rose (1998) had opened debate on the endogeneity of the OCA criteria. Their argument had contradicted with another popular argument from Krugman (1993) that postulates increased economic integration increases the likelihood of asymmetric shocks. Krugman's hypothesis was based on the possibility of increased localised specialisation which increases rather than decreases the divergence of disturbances between two countries, thus increasing the cost of forming currency union. This view is also supported by Eichengreen (1990) and Bayoumi and Eichengreen (1992; 1994). On the other hand, there are empirical evidences that support the hypothesis laid by Frankel and Rose (1998); for example, Artis et. al., (1995) had shown that increased trade links in Europe would lead to business cycle co-movement, thus shocks tend to be more symmetric. Fidrmuc (2004) also tested the endogeneity of

OCA theory to prove Frankel and Rose's proposition; he concluded cautiously that the effect of increased trade may increase the structural similarities of a currency area, as previously proposed.

In summary, the new theory of OCA reconsiders the effective costs and benefits from monetary integration. As compared to the old theory of OCA, it indicates that costs of monetary integration in terms of loss of national monetary policies are likely to be less than original thought. It also points out that the benefits of forming a currency union in terms of credible low inflation is underestimated in the traditional theory. The difference between modern and traditional view is that modern view emphasise more on potential benefits, while the traditionalists are more emphasised on the costs of monetary union. Despite the emergence of the new OCA criteria, still the traditional contributions are still relevant. The following table 3.1 would summarize the most important attributes regarding optimum currency areas.

Table 3-1: Some selected characteristics of optimum currency areas

Variables	Effect
Symmetry/Similarity of shocks	The more symmetric macroeconomic shocks of potential members of a currency area the less important of independent monetary policy.
Business cycle synchronisation	The need of flexible exchange rates as an adjustment tool is reduced when potential members of a currency area have synchronised business cycles.
Economic Openness	The openness in the economies of a potential currency area will strengthen the possibilities of joining/forming a monetary union.
Endogeneity	Increased economic integration makes countries fulfil the criteria of forming monetary union ex post rather than ex ante.
Specialisation	Specialization of production and services in a country increases the possibility of joining a monetary union ex ante rather than ex post.
Mobility in labour	The higher labour mobility (when prices and wages are fixed) the higher possibility of joining a monetary union.
Mobility in capital	The more capital mobility in a currency area, the more benefit to gain from a fixed exchange rate.
Flexibility in wage and price	Flexibility of price and wage in a monetary union area will reduce the asymmetric shocks and thus the monetary union area will become stable.
Diversification of production/exports	More diversification in production would be beneficial for the formation of monetary union.
Economic size	The bigger economic size, the more striking exchange rate is flexible.
Reduced of inflation differentials	Similarity of inflation rates between countries will increase the chances of maintaining fixed exchange rate.
International risk sharing	If potential members of a currency area are willing to share their risk then common currency would be beneficial.
Monetary shocks	Monetary union which entails fixed exchange rate is good for countries facing monetary shocks.
Credibility of monetary authorities	Monetary union which entails fixed exchange rate is beneficial for countries that don't have credible monetary authorities that control inflation.
Effectiveness of monetary policy	In efficiency of monetary policy would reduce the cost of losing monetary independence.
Effectiveness of exchange rate adjustments	In efficiency of exchange rate adjustments would decrease the burden of losing the exchange rate as adjustment tool.

3.1.3 Monetary Union and the Concept of Economic Development

The criteria of collectivism and unity have always been considered as one of the strength in the discourses of development that either considered economic or social development (Alam, 2009a, 2009b). Independence of a state always does not necessarily reflect a division or dispersion of the community. Therefore, regional union for the development and cooperation has played a critical role towards development, while many regions are struggling to be independent, thinking a microeconomic perspective (Bénassy-Quéré & Coupet, 2005) when many regions, having same culture, attitude and norms are trying to be in consensus of forming monetary union in order to be a macro voice of development (Cooper, 2000; Jabko, 1999). Considering these views, European Union (EU) was formed, increase success of EU shows a way that testify how unity, harmony, team work and team spirit can play a rigorous role for the development.

Primarily, the economists (for example, Bernstein, Shultz, Psacharapolous) view development in terms of the nation's relative prosperity, which is measured by the gross national product (GNP), as highlighted by Alam et al. (2009a). However, there is a concern that greater income does not guarantee greater buying power, more choices or better quality of life. This is partly due to globalization and free economic trade that made it challenging to maintain a reasonable inflation rate. An interesting point is noted by Alam (Alam, 2009a, 2009b) who states that if there is an exceptionally high gap existing amongst the value of GNI (gross national income) and GNP and GDP (gross national product and gross domestic income), national development will not sustain or would halt the development ultimately for two reasons:

i. If the value of GNI is enormously lower than the value of GNP and GDP, people of the producing nations cannot survive since a higher cost has already been paid off for the GDP and GNP.
ii. If the value of GNI is extremely higher than the value of GDP and GNP, the competitive nation will take the advantages supplying the desired products to the international community once they find out that a specific producing country sells a particular product at a higher cost to the other nations. This is easier to find out as the recent explosion of IT and ICT become available to all.

A further point was raised if a number of nation increases their GDP, GNP and GNI with the help of importing raw materials and other inevitable supports needed in the 21 century (such as, internet, global transit and protocol) from one specific region or nation, it would not help them greatly as it will provide compound escalating benefits to that specific region or nation. Therefore, on balance, those countries will face gruelling challenges on bilateral and multilateral business competition due to shortage and low value of foreign currency. This situation would be graver with more globalisation and internationalization.

More importantly, growth in economy without development in politics and society may lead to corruption caused by lack of transparency, maturity of the society and participation of the individuals within a nation (Alam, 2009b). Development in politics includes separation of power among the executive, legislature, and judiciary, judiciaries' transparency, free and fair election, etc. Development in society includes maturity of the society wanting transparency, fairness, security, knowledge, freedom of choice and participation in the decision making for the society. The concerns from all these aspects have led to the emergence of another school of thought, that is, the sociologists' perspective.

3.1.4 The Role of Monetary Functions for Human and Business

Monetary policy consists of the decisions and actions taken by the government to affect the supply of money and credit within a jurisdiction. Monetary policy has two basic goals: promoting the highest sustainable levels of economic output and employment, and promoting stable prices. Monetary policy is also used as a means by which government may respond to shocks to its economy. A stable money supply plays a crucial role in economic growth. The monetary authority may expand or contract the money supply in order to accommodate shocks. For example, if the supply is too large, inflation results. And if the supply is insufficient, it makes it more difficult for firms and consumers to get credit to finance large purchases and business expansions. Whether or not monetary policy has real effects on the domestic economy has been a matter of theoretical and empirical debate among economists (Martin, 1999).

Also, monetary policy is a powerful tool for affecting wealth accumulation, and has real effects on the economic system. Monetary policy is important for economic growth, as well as for domestic stabilization policy (Martin, 1999). Monetary policy can facilitate growth by pursuing policies conductive to increase production and real wealth; thus, this economic growth is associated with a more rapid reduction in poverty (Dollar & Kraay, 2002). Monetary policy can be used as a tool for stabilizing the financial system and unemployment rate; this would decrease the burden of debt and the poverty level (Martin, 1999).

3.1.5 The Preface of Introducing Monetary Union

According to the experience of European Monetary Union, the road towards their formation of currency union was challenging and it took many years to reach. In general, regional integration is a gradual process comprising the following six additive/chronological levels (Armengol, 2004):

- **Preferential Trade Area (PTA):** PTA is perhaps the weakest form of economic integration; its members apply lower tariff reductions, but not completely eliminating, to the products of member countries. Countries in PTA agreement can decide their own tariffs on imports from third parties.
- **Free Trade Area (FTA)**: FTA is bit stronger than the PTA agreement, as FTA agreement entails elimination or significant reduction of tariffs between members. The objective behind FTA is strengthening the economies of scale and comparative advantages of trade.
- **Custom Union**: Custom union is a free trade area (FTA) with common external tariffs among members, in other words, members of custom union should apply same tariffs to third parties; this addresses the problem of re-exportation.
- **Common Market**: In this type of agreement, factors of production such capital and labour are freely moving within members of common market, the aim is to expand economies of scale and attain comparative advantages.
- **Economic union**: Economic union involves fixing exchange rates and coordination and harmonization of fiscal and monetary policies between members.
- **Political union**: This is the last goal and most advanced form of regional integration, it involves the amalgamation of political systems of the region under common government.

As mentioned in above, monetary union is the 5th[2] stage of integration and a region should have to fulfil the preceding stages of integration before forming monetary union (African Development Bank, 2010). Monetary union has prerequisites which include sufficient degree of economic and financial integration to enable member countries to enjoy the benefits of lower transaction costs and exchange rate risk from the start of monetary union. To achieve a strong and viable currency union the following steps are recommended to be considered, and the fulfilment of these steps require strong political commitment (European Central Bank, 2010):

- It necessary to prepare the legal documents of monetary union treaty and the rules and regulations of governing the Central Bank of the community.
- It is necessary to prepare the regulatory and operational framework of the currency union;
- It is necessary to achieve macroeconomic convergence between potential members of a currency area; this will increase the successfulness of the formation of currency union and at the same time will increase the benefits without incurring unnecessary costs.
- Finally, it is necessary to be well prepared for the changeover from national currencies to a common currency, which must be properly adopted in society and particularly in the financial sector.

[2] The degree of economic integration can be categorized into 6 stages: Preferential Trade Area, Free Trade Area, Custom Union, Common Market, Monetary Union and lastly Political Union.

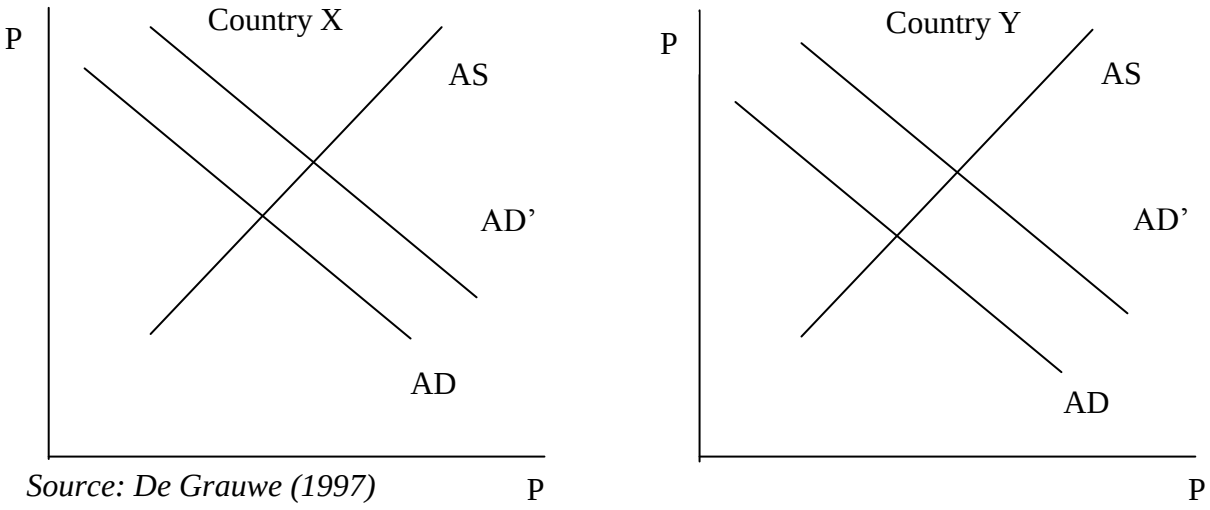
3.2 The Benefits and The Costs of Joining Monetary Union

Cost benefit analysis approach is one of the ways to assess currency areas. When a country or countries enter into a monetary union there are both costs and benefits associated with that step. It is therefore reasonable for potential members to try to identify these potential costs and benefits before they decide to join a currency union. Thus, this section discusses the costs and benefits approach to OCA in general form and give a few specific examples. This discussion on the costs and benefits analysis is based on Mongelli's paper (2002).

Mongelli (2002) for example suggested for potential members of currency union to evaluate the benefits and costs of joining a monetary area based on self-interest and overall welfare. He adds that it is difficult to assess all costs and benefits since they may reflect different policies over time. A case in point would be that in early stages of a currency area relative to the time when it can fully exhibit the benefits in internationally and domestically (Mongelli, 2002). Further, the benefits conferred to member countries may vary between large and small members or for countries that displayed high inflation prior to joining a union.

The new OCA theories examine which countries or regions would be good candidates for a common currency area based on cost benefit analysis; while traditional OCA theory was criterion based. The new OCA theory predicts that costs of using a common currency depends on how symmetrical the economies are in terms of business cycles and vulnerability to disturbances and the easiness of economies to adjust disturbances (Alturki, 2007). The following figure 3.1 would explain how the new OCA theory judges the benefits and costs of a region willing to form monetary union.

Consider there are two countries in a region willing to form a monetary union, country X and country Y; assume that there is an aggregate demand fall only in country X of that region, while the opposite country Y had aggregate demand increase, in such case countries cannot use flexible exchange rate regime to bring back the countries to the equilibrium. Countries should choice either to get rid of unemployment or inflation, but not both problems at a time. Thus, we can say these countries are having asymmetric shocks and the costs of losing national monetary and exchange rate policies are expected to be less than the benefits induced by a monetary union. If these countries for a monetary union while they are having asymmetric shocks they are likely to face high adjustment costs; see figure 3.1.



Source: De Grauwe (1997)

Figure 3-1: The costs and benefits of a region willing to form monetary union

Implementation of monetary union in an area increases the number of people using that common currency as a medium of exchange. Thus, the people in the currency union area would not need to exchange of one currency to the other. As a result, the transparency of prices will increase and transaction costs will decrease, resulting satisfied consumers and extended volumes of trade in goods and services (Kwack, 2004). According to empirical studies, monetary union area promotes intra-regional trade and saves transaction costs. For example, the European Community Commission

had estimated to gain a savings of about 0.5% of their total production in exchange transaction costs for the whole Community (Artis, M. J. 1991). Glick and Rose (2002) stated that countries using common currency would experience approximately doubling of their bilateral trade. Conversely, adoption of currency union entails reduction of seigniorage revenues of printing independent currencies by the central banks of member countries. But the benefits created from trade expansion are expected to be bigger than the reduction of seigniorage revenues (Kwack, 2004).

Following are the summary of the benefits of an individual member country may gains from joining a monetary union:

1. Lower transaction costs and easiness of international transaction in the union, which will foster regional trade. In other words, MU would create & accumulate wealth as a result of the elimination of trade barriers associated with the existence of multiple exchange rates.
2. Elimination of exchange rate uncertainty will give potential members of a currency area a price stability and protection of foreign exchange risk. This means it reduces transaction costs of currency conversions and would enhance the role of money as a medium of exchange.
3. Economies of scale through extended market areas which are expected to bring benefits to consumers in the form of reduced prices.
4. The central banks of potential members of currency union will no longer need to hold their foreign exchange reserves to settle intra-trade transactions.
5. A monetary union may give lower inflation rates and stable prices to the inflation-prone countries, through credible monetary strategies of the union.

Some of the costs faced by the countries members of a currency union are:

1. Loss of sovereignty of monetary policy, which might be a problem when fighting inflation or recession.
2. Loss of control over the foreign exchange value of a national currency, which will eliminate the opportunity to smoothly adjust domestic policies in case of crises (Martin, 1999). Exchange rates may be useful instrument for countries to affect their balance on current account (Destler & Henning, 1989).
3. Adjustment problems for the average citizen to the new the currency (coins and notes) with different denominations as compared to the old one.
4. Loss of fiscal policy, fiscal policy may be useful for collecting revenue, distribute income and finance government purchases; these policies will encounter limitations if a monetary constitution restricts fiscal policy (Martin, 1999).

3.3 Operationalization of OCA Theory

Monetary union has existed more than half a century and there is huge literature and methods of operationalizing the OCA criteria. In old days, it was customary to test the individual hypotheses postulated in the traditional OCA literature. After the new OCA theory had emerged, it had become customary to analyse OCA in a "catch all" method, this method can capture the interaction of the several properties of the traditional OCA theories like openness, mobility of factor of production, and diversification etc. "Catch all" method of OCA analysis includes the following models: 1) Analysis of economic shocks (SVAR), 2) Analysis of synchronization of business cycle, 3) Correlation and Cluster Analysis, 4) Generalized-PPP Analysis, 5) Trade Effects (Gravity Model), and 6) Dynamic stochastic general equilibrium modelling (DSGE). This thesis mainly uses the structural vector auto-regression (SVAR) model and business cycle synchronization analysis; therefore, we will elaborate more about these topics in the literature.

3.3.1 Theoretical Frame Work of SVAR Model)

Structural Vector Autoregression (SVAR) is defined as a multivariate model with linear representation of a vector of observables on its own lags and usually goes together with other variables such as a trend, dummy or constant (Villaverde & Ramírez, 2007). SVAR models are popular in identifying assumptions to estimate the effect of policy on the economy while keeping the model free from many additional restrictive assumptions needed to give every parameter (Guo, 2005). SVAR was introduced by Sims (1980), and is widely used in modern macro-econometric analysis (Caldara, 2011) such as the analysis of macroeconomic shocks in supply and demand on business cycles by Blanchard & Quah (1989), the effects of money on output by Sims and Zha (2006), the effects of fiscal policy by Blanchard & Perotti (Blanchard & Perotti, 2002) or the relation between technology shocks and worked hours by Gali (1999). The intuition behind SVAR model is that if countries experience symmetric or similar disturbances of aggregate supply and aggregate demand then they can form a monetary union.

One of the premier objectives of this thesis is to assess the suitability of currency union in the East African Community based on Mundell's theory of optimum currency areas. The operationalization of the OCA theory through the analysis of supply and demand shocks was first introduced by Bayoumi and Eichengreen (1992); they employed a structural VAR model grounded on the AD-AS framework which postulates that in the long run, a demand shock has no effect on output, while a supply shock has an effect on output and price level both in the long run and the short run. This would be elaborated more in the following section (5.2.3) on identification strategy.

Bayoumi and Eichengreen (1992) had measured the underlying aggregate supply and demand shocks of members in European Community (EC) and compared their results with the aggregate supply and demand shocks existing in the United States. In their analysis, they separated the observed economic variables (i.e. GDP and prices) and underlying structural shocks and subsequently traced out the responses of the observed economic variables in the system to disturbances; this way of disturbances analysis is relevant to the decision of whether monetary union is feasible or not (Guo, 2005).

In another similar study on currency union conducted in different regions of the world, Bayoumi and Eichengreen (1994) applied the SVAR model on East Asian data and identified the demand and supply shocks followed by an estimation of the correlations of underlying shocks in the economy. In their results, they found two groups of countries that are likely to establish a currency union in East Asia: 1) Singapore, Indonesia, Malaysia and Hong Kong; and 2) Japan and Korea. The OCA theory postulates that, countries are better candidates to form a monetary union if their disturbance size is small and correlated. The following section provides the identification techniques for the shocks.

In summary, SVAR models are based on the economic theory and they provide a powerful and convenient framework for policy analysis (Rubio-RamiRez, Waggoner, and Zha, 2010). SVAR model has two main constrains and they are as follows: first, SVAR models have great number of parameters and secondly, SVAR models lacks of the identification of the causal ordering of the variables of the system.

3.3.2 Theoretical Frame Work of Business Cycle Synchronization

The economic ups and downs of specific economy are called business cycle. The business cycle entails changes over time between periods of accelerating growth (prosperity period) and periods of decelerating growth relative stagnation or decline (recession period). Business cycle is the persistent periods of contraction and expansion of economies, in other terms it is the deviation of output from the trend. The most common indicators of business cycle fluctuations are industrial production indexes and growth of real gross domestic product. Economists have measured and studied these fluctuations for more than a century. Business cycles have an impact on production, inflation, sales, employment, performance of stock exchanges, spending, and many other aspects of the economy (Anon, 2001). Leslie (1993) says that business cycles are all about the volatility or fluctuations in real output and employment. Finally, business cycle is an inevitable economic phenomenon and it is the way that growth takes place.

Synchronization of business cycles analysis is one of the methods of testing OCA criteria. It is an alternative method of analysing similarities of economic structures of a group of countries interested in forming monetary union. Synchronization of business cycles analysis tries to evaluate similarity of contractions and expansions of economies in a group of countries, and it help us identify subsets of countries that share similar economic properties. This approach is widely used in the OCA literature as a tool to determine whether future members of a currency union face correlated trend and cyclical components of their macroeconomic indicators such as GDP, inflation, consumption, investment, and unemployment. The business cycle method of this study is to identify business cycles using a range of trend cycle decompositions as well as by a turning point analysis; in other words, we use de-trended time series as cyclical measures.

Synchronization of business cycle is an important condition for successful implementation of currency union, as it helps to have a coordinated monetary policy. The concept of business cycle synchronization with relation to optimum currency area is that: if the cyclical fluctuations of potential members of currency area present in same phases, then the benefits of establishing common currency would be higher than the expected costs; the opposite would prevail if, the cyclical fluctuations of economies behave in contrary phases. Hence, business cycle synchronization analysis is a useful tool to identify potential members of a currency union and their associated costs. Literature shows that intra-regional trade reduces economic dissimilarities and makes similar business cycles. To this end, coordinated fiscal and monetary policies would improve the synchronization of business cycle (Frankel J. A. & Rose, A. K. 1998).

According to the business cycle theory, business cycle fluctuations can be accounted for by real shocks to a large extent. Real shocks are shocks to technology, investment or labour supply that affect the aggregate supply. Usually, business cycles are regarded as fluctuations that occur with a frequency of 3 to 5 years. Business cycle synchronization evaluates how the cyclical behaviour of economic aggregates of a group of countries evolves through time. Real GDP, industrial production index (IPI) and unemployment rate are common business cycle indicators (Kwan, 2009).

In the short run, the economy is mainly affected by three types of economic shocks – country-specific shocks, common shocks, and industry-specific shocks. Common shocks can be regarded as a third party that affects business cycle synchronization between two countries as it has effect on both countries. Country-specific shocks and industry-specific shocks directly explain the economic interaction between two countries (Kwan, 2009). Common shocks are greatly spread across borders and hit

every country at the same manner and time. The oil price crisis, Asian Financial Crisis and World War are notable examples. The negative oil supply shock in 1974 led to real industrial production decline in all G7 countries. France entered the recession in August 1974 when Japan had already experienced the recession for 7 months. Common stocks are one of the reasons for business cycle synchronization.

Unlike common shocks, country-specific shocks capture all fluctuations that never spread across borders. Shocks that affect all sectors in the economy are country-specific aggregate shocks. Country-specific aggregate shocks are unique for every country and thus become one of the reasons for idiosyncratic business cycles. Shocks due to a country's policy, either expansionary or concretionary, are one of these shocks. Industry-specific shocks make the economies of countries more synchronized if these countries have similar sector shares.

Countries with different sector shares are less synchronized, whereas those with similar shares in the affected industries are more synchronized. Cross-country business cycle synchronization can be attributed to common shocks, country-specific aggregate shocks and industry-specific shocks. These shocks are transmitted from one country to the other through the following main channels –international trade in financial assets, international trade in goods and services, and cross-country linkage of production sectors. The impact of some factors on business cycle synchronization can be explained by the above shocks.

3.3.3 Generalized-Purchasing Power Parity Analysis

The Generalised Purchasing Power Parity (G-PPP) is one of the popular techniques used to assess suitability of membership in currency union; it tests whether real effective exchange rates of potential members of currency area are co-integrated. The G-PPP model was first developed by Enders and Hum (1994) to evaluate the extent movement of real exchange rate in group of countries. Similarity in real exchange rates of group of countries corresponds to similarity of economic structures in that group of countries, and hence, currency union is feasible (Adams, 2005; Laabas & Limam, 2002; Rusuhuzwa & Masson, 2012).

The G-PPP model postulates that the higher co-integration of real effective exchange rates in a group of countries, the more benefit they gain from establishing currency union. Mkenda (2001) and Rusuhuzwa and Masson (2012) had used G-PPP model to assess feasibility of currency union in East African Community, in their results they found existing co-movement of real effective exchange rates between members countries of East African Community. OCA theory suggests that synchronized economic structure will reduce the cost incurred from currency union. Both Mkenda (2001) and Rusuhuzwa and Masson (2012) have concluded that EAC could constitute an optimum currency area, based on G-PPP co-integration assessment.

There are other similar studies that have used G-PPP method in assessment of which countries should form a currency union. For example Laabas and Limam (2002) and Nusair (2012) have assessed similarity of exchange rate movements in GCC countries and found closely related exchange rate movements, hence points GCC readiness to form currency area. The difference between these two papers was the coverage of data period, Laabas and Limam (2002) used 1960 – 1999 while Nusair (2012) used data ranged from 1973 – 2009. The following studies are examples of G-PPP model used in

assessing feasibility of monetary union in other regions of the word: Ogawa et al., (2008); Ahn et al., (2006); Aryeetey (2004); Johns (2009) Rofael et al., (2011) and so many others.

On the other hand, it is obvious that co-integration analysis alone is not enough to conclude optimality of currency area in a region, because the assumption of similarity in exchange rates corresponds to similarity in economic structures is too implausible. Political interventions by government can change the real exchange rates without any underlying economic causes. Thus, it seems in appropriate and in accurate to use G-PPP model alone to assess feasibility of currency union in a region; and it deserves to mention that similarity of exchange rates in a region is only one condition of OCA theory. Another main critic to the G-PPP model is that movements in the macroeconomic variables of G-PPP do not distinguish disturbances from responses (Buigut, 2005).

3.3.4 Trade Effect Analysis "Gravity Model"

Gravity model is one of the popular methods to test endogeneity of OCA criteria; it explores whether membership in currency union would increase the bilateral trade among potential members of monetary union (Salvatici, 2013; Poot, J. 2004). Gravity model for international trade was first used by Tinbergen (1962) followed by Poyhonen (1963) and have assessed the impact of trade agreement on regional economy; this gravity model for trade is similar to the Newton's gravity of physics, it states that, bilateral trade of countries would flow to the direction of economic mass (often measured by GDP) (Riaz, 2013). Since its inception, extensive literature on gravity model has been formed, but on the other hand, the theoretical justification of the model had been subject to dispute and criticized with its luck of microeconomic foundations (Kepaptsoglou et al., 2010; Rose, A. K. 2000).

The Gravity model equation would have the following structure and variables: average value of bilateral trade is used as a dependant variable and regressed against the following variables; real gross domestic product, population, physical distance, surface land mass of the country, dummy variables (shared language, shared border, shared trade agreement, shared coloniser, and the variability of the effective bilateral exchange rate between i and j (Adams, 2005; Balogun, 2008; Poot, J. 2004). Although, the equation structure of the Gravity model consists of variables that pertain to spatiality and geography, yet, the model has been extensively used in testing hypothesis that are purely founded in economic theories of trade. Thus, gravity model has restriction in linking economic theories with empirical results of the model (Frankel, J. A. 2008; Rose, A. K. 2000; Salvatici, 2013).

Proponents of endogeneity of OCA theory argue that currency union would have large positive effects on international trade (Fidrmuc, J. 2004). After the successful implementation EMU, a lot of researchers have studied the endogeneity effect of OCA theory. Rose, A. K. (2000) is one of the earlier scholars assessed the impact of currency unions on bilateral trade; he used a panel data set of 186 countries spanning from 1970 until 1990; he reported that currency union leads to a three-fold increase in bilateral trade among currency union members compared to non-members (Rose, A. K. 2000). A similar conclusion was reached by Frankel and Rose (2000); they have also used a paned data of 180 countries ranged from 1970-1995; they stated that when two countries share a common currency, trade is multiplied roughly threefold (Glick & Rose, 2002). In summary, gravity model of trade is an excellent model to assess the impact of monetary union on bilateral trade, but unfortunately, it's theoretical justifications are the subject to dispute and lucks microeconomic foundations (Adams, 2005; Tayyab et al., 2012).

3.3.5 Dynamic Stochastic General Equilibrium Model

Dynamic stochastic general equilibrium (DSGE) models have become an appealing methodology used to analyze various questions in economic growth, business cycles, fiscal and monetary policy problems, and other fields in macroeconomics and international trade (Fernández-Villaverde, 2010; Flotho, 2012). Many publications on contemporary macroeconomics and monetary union analysis have used DSGE framework. One of the reasons behind the appealing popularity of DSGE model is that – unlike conventional macro-econometric forecasting models – DSGE models are not vulnerable to Lucas critiques on traditional econometric models (Woodford, M. 2003; Rudebusch, 2005).

As the name implies, Dynamic stochastic general equilibrium (DSGE) models are dynamic, assesses how the economy evolves over time; they are based on the assumptions of stochastic disturbance, taking into consideration that the economy is subjected by random shocks such as fluctuations in output and prices, technological change, or errors in macroeconomic policy-making (Fernández-Villaverde, 2010; C. E. Tovar, 2008). This scenario is different from the static models studied in Walrasian general equilibrium theory, applied general equilibrium models and some computable general equilibrium models (CGE). Although DSGE models appear to be a relatively appealing methodology; yet, it is highly complicated process, reliant on detailed economic data which makes it unsuitable for its application to East African Community (EAC) where such data is scarce. Thus, currently using DSGE model on the analysis of monetary union in Africa is beyond our capacity.

3.4 Past Empirical Studies on OCA

In previous section we had discussed the theoretical literature of optimum currency area, but in this section we present past empirical application on monetary union, with special reference to the empirical literature of asymmetric shocks across countries and synchronization of business cycle. The literature on the asymmetric shocks constitutes the core of the debate in the monetary union topics. Many research papers have studied the synchronization of business cycles and the degree of shock asymmetry across countries; they used Structural Vector Auto-Regressive (SVAR) models and HP (Hodrick-Prescott) and the BP (band pass) filters to assess feasibility of optimum currency area. This section is divided into two subsections; past empirical studies on SVAR and past empirical studies on BCS.

3.4.1 Past Empirical Studies on SVAR model

This model is one of the popular methods to assess optimum currency area; since its inception, huge literature on empirical analysis of SVAR on different parts of the world has formed. Most of empirical reviews on SVAR were concentrated on European Monetary union. Bayoumi and Eichengreen (1992) were the first to pioneer the supply and demand shock analysis as a way to operationalize the theory of optimum currency area. They used VAR decomposition to analyze data on gross domestic output and prices for eleven European Community member countries in order to determine the underlying disturbances of aggregate supply and demand. The pattern of macroeconomic shocks of European countries and their speed of adjustment were compared with those of United States data. The finding showed that the EC country shocks were significantly more idiosyncratic than those across the US, indicating a more problematic European monetary union than that of the US (Al-Barwani, 2006). The two authors suggested in their study two regions in Europe: the essential countries

(Germany, Netherlands, Belgium, France and Denmark) and the peripheral countries (Portugal, Greece, Ireland, United Kingdom, Italy and Spain).

Bayoumi and Eichengreen (1994) had examined the feasibility of currency union in East Asia countries, Western European countries, Latin American countries and the North American countries including Canada and United States. According to their results, they found three clusters of regional blocs: 1) Northeast Asian Bloc (Taiwan, South Korea and Japan), 2) Southeast Asian Bloc (Malaysia, Thailand, Singapore, Indonesia and Hong Kong) and 3) Northern European Bloc (Belgium, Netherlands, Denmark, Switzerland, Germany, Austria and France). They also found that Lan American countries are less feasible to form currency union but the North American countries including United States, Canada and Mexico may come together to form the North American Bloc.

In another paper of Bayoumi, Eichengreen and Mauro (2000), they investigate the feasibility of currency union for East Asian countries; they based their estimates on the correlations of supply and demand shocks among the countries. They had grouped the East Asian countries into two groups, Group one which includes Thailand, Malaysia, Indonesia, Singapore and Hong Kong; and group two which includes Taiwan, Korea and Japan (Han, 2009). The seminal contribution of Bayoumi and Eichengreen's SVAR model had attracted the attention of many scholars and policymakers to the field of currency integration analysis; since then, huge literature of monetary union analysis in different countries had formed as many researchers had applied SVAR technique (Fidrmuc J. & Korhonen, 2006).

The following selected studies Frankel et al., (2005), Ramos et al., (2004), Horvath et al., (2004) and so many other studies have assessed have assessed EMU using SVAR model. Frankel et al., (2005) had used VAR to evaluate the similarity of macroeconomic shocks between the countries of the Central and Eastern European countries (CEECs) and compared with shocks of the Euro area countries; they used quarterly data of the period 1993-2001, they found that substantial differences in shocks between CEECs and the Euro area, but the differences are declining across the time.

Ramos et al., (2004) have assessed the effect of Euro enlargement on not yet joined euro countries, using structural vector Autoregression models they found shocks are more asymmetric in countries that have not yet adopted the euro than current euro-zone members; dissimilar with the results of Frankel et al., (2005), differences in shocks were substantial in recent years. Similarly, Horvath et al., (2004) have used bivariate Structural Vector Auroregression model to assess the degree of symmetry in shocks among members of euro currency area and candidate countries that have not yet adopted the euro. They found idiosyncratic shocks among members of existing euro currency area and countries not yet members of euro; they concluded that enlargement of euro by joining new members would be costly.

The following selected studies Ling, (2001); Tang, (2006); Jeon et al., (2007); Huang Y., & Guo, F. (2006) and many others have assessed feasibility of monetary union in east and north Asian countries using SVAR model. These authors have assessed suitability of monetary union in East Asian economies on the basis of symmetry in macroeconomic disturbances, they have used two variable SVAR model to identify potential candidates for monetary union. Their overall findings didn't support the formation of a fully-fledged currency union in the region at the moment; instead they suggest the formation of smaller sub-groupings within the region (Huang & Guo, 2006).

On the other hand, Ng T. H. (2000), Zhang, et al., (2004) and Hsu, (2010) have used a three variable SVARs to assess the desirability and viability of a single currency arrangement in East Asian Economies, according to their empirical results they did not provide strong evidence of the formation of currency area in the region. Instead they found that it would be more beneficial and less costly to establish smaller sub-regional groupings of currency area, for example, Huang Y., & Guo, F. (2006) had suggested regional sub cluster of Indonesia, Thailand Hong Kong, Malaysia, Korea and Singapore; while Zhang Z., K. Sato, & McAleer, M. (2004) had shown that the following countries Malaysia and Indonesia, and Malaysia and Singapore experience major positive correlation of supply shocks. Compared with the North American Free Trade Agreement (NAFTA) countries, the ASEAN countries have more symmetric external shocks but less symmetric supply and demand shocks (Ng, 2000).

Also, the studies of feasibility of monetary union were conducted on Gulf Cooperation Council (GCC), and huge empirical literature on this region have formed and is available; mentionable, Abu-Bader & Abu-Qarn (2006); who had studied the effect of macroeconomic shocks on GCC countries, Abu-Bader & Abu-Qarn (2006) used bivariate structural VAR (SVAR) model. They found that GCC countries are symmetric in demand shocks while they are asymmetric in supply shocks. In another study done by Louis, Balli, & Osman (2008) studied the appropriateness of common currency in GCC countries using the symmetry of macroeconomic shocks on the bases of two variable structural VAR model that comprises output and prices. They found that non-oil aggregate supply shocks are weakly symmetric while aggregate demand shocks are totally symmetric across GCC countries, thus, monetary union is feasible in the GCC (Al-Barwani, 2006).

Let's now review some of the most important empirical studies of monetary union in African countries. Empirical research of optimum currency area on Africa began in early 1990s and became popular in the recent years, late 2000s. A study by Assane and Pourgerami (1994) had analysed monetary cooperation and economic growth in Africa, they compared economic performance of West African Monetary Union with that of Sub-Saharan African countries (23 countries of non-zone). In their results, they found that African economies have experienced similar growth trend. Bayoumi and Ostry (1997) had also applied the OCA theory to Sub-Saharan African countries by examining the correlation and size of the real underlying shocks across the Sub-Saharan African countries and their level of intra-regional trade. They found that most of Sub-Saharan African countries are less likely to be good candidates for an OCA because of low intra-African trade implying a non-synchronization of the terms of trade shocks (Sissoko, 2003).

Fielding and Shields (2001) assessed the optimality of currency area in two francophone monetary unions in West African countries. In their study they used bivariate SVAR model with emphasis on disturbances to aggregate price inflation and to aggregate output growth. They found asymmetric shock in the bloc thus they propose the necessity of rescheduling of the internal boundaries of the Francophone monetary zone. Cham (2007) in his PhD dissertation had analysed the benefits and costs of currency union on West African Monetary Zone (WAMZ). He had used SVAR model to study the macroeconomic shocks of the region, also he had used Gravity model to measure how currency union would enhance the intra-regional trade, income and the welfare of the society. He concluded that these countries face significant challenges before they form monetary union.

Moreover, Horvath and Grabowski (1997) had empirically assessed the possibility of economic integration among African countries in the light of optimum currency areas theory of Robert Mundell; they assessed the similarity of disturbances affecting the economies of African states by using a bivariate SVAR decomposition model founded by Bayoumi and Eichengreen (1992). In their results they found asymmetric supply shocks and symmetric demand shocks affect the African countries during the period of 1960-1992. These countries include five countries of Northern region, fifteen countries of Western region, eleven countries of Eastern region, and seven countries of Southern region of Africa. These results suggest that African countries are less feasible to form currency union but smaller scale monetary arrangements might be possible.

It seems that studies of monetary union in Africa are mainly focused on the CFA franc countries; perhaps this may be due to that these countries are already engaged in a relative more integrated monetary system compared to the other Africa states and also they have relatively good quality of relevant data (Adams, 2005). On the other hand, there are relatively few studies of monetary union in East African Community. Mkenda (2001) is one of the scholars who had examined the prospects of integration among East African Community; he employed a G-PPP approach to identify whether East African countries have long run relationship in real effective exchange rates. He found co-integrated real exchange rate among EAC members; thus, suggesting the formation of a monetary integration in the region. GPPP methodology for identifying the long run relationship of macroeconomic variables got limitations, as macroeconomic movements reflect the combined effects of disturbances and responses, in other words, G-PPP approach cannot distinguish disturbances from responses (Angeloni & Dedola, 1999; Buigut S. K. & Valev, 2005b). Bayouimi and Eichengreen (1992) had provided a better identification scheme which solves the limitations G-PPP method.

Buigut S. K. & Valev, (2005a) was the first to measure the symmetry and asymmetry of underlying macroeconomic shocks in the East African Community (Kenya, Uganda, Tanzania, Rwanda and Burundi) using bivariate SVAR approach. Their study follows the methodology of Bayoumi and Eichengreen (1992), he used real gross domestic product (GDP) and the real GDP deflator, and the data he used ranges from 1970 to 2001. According to the Buigut results, East African Community is dominated by asymmetric shocks, only Kenya and Burundi had demonstrated positive and significantly correlated supply shocks. Therefore, the results did not show strong support for the formation of currency union at the moment but do reveal the need of more integration.

Mburu (2006) had assessed the political and economic feasibility and desirability of East African monetary union. He used synchronization of business cycle analysis and shocks criterion. He concluded that the adoption of regional OCA is currently inappropriate because there are insufficient evidences of long-term macroeconomic convergence among the East African countries. He argues that intra-regional trade among east African community members is low as is the degree of factor mobility. Also, on the political side, he pointed out that the EAC countries lack a political institutional structure to sustain a monetary union among the sovereign states.

A recent study by Mafusire and Brixiova (2012) assessed empirically the readiness of monetary union in East African Community. Similar to our study, Mafusire and Brixiova (2012) used structural vector auto-regression model and then examined the underlying macroeconomic shocks affecting the region. They found relatively low degree of symmetry in the shocks affecting the region, suggesting that formation of

monetary union should not be rushed and instead to emphasize more on the economic convergence between the EAC member countries.

Table 3-2 Selected empirical studies on SVAR model and BCS analysis, 1999-2009

Author(s)	Methodology	Area	Conclusions
Frenkel, M., Nickel, C., & Schmidt, G. (1999)	SVAR	Latvia, Slovakia, Hungary, Czech Republic, Bulgaria, Estonia, Slovenia, and Poland, vs Euro 17	The study results suggested EMU extension towards eastern European and central countries would result higher costs than EMU enlargement towards countries of the other two groups
Horvath and Rátfai (2004)	SVAR	Lithuania, Slovakia, Hungary, Estonia, Czech Republic, Latvia and Poland vs Euro 17	The study results suggest a costly process of adjustment following EMU enlargement
Fidrmuc and Korhonen (2004)	SVAR	Lithuania, Slovakia, Hungary, Estonia, Czech Republic, Latvia and Poland, and Bulgaria vs Euro 17	The study found some degree of correlation of shocks among several countries, and suggests that more integration enforcement would increase more in symmetry of demand and supply shocks.
Ramos and Suriñach (2004)	3SVAR	Lithuania, Slovakia, Hungary, Estonia, Czech Republic, Latvia and Poland vs Euro 17	The study found that correlations are still far from the values of the euro-zone countries, the flexibility of real sector and labor markets will be essential for the sustainability of joining the euro
Backé et al. (2003)	HP Filter (inflation)	Lithuania, Slovakia, Hungary, Estonia, Czech Republic, Latvia, Slovenia, Poland and Bulgaria	The paper draws conclusions about future monetary and exchange rate policy options in the run-up to EU accession and beyond.

Traistaru (2004)	HP filter (GDP)	Lithuania, Slovakia, Hungary, Estonia, Czech Republic, Latvia, Slovenia and Poland	They found some relationship between similarity of economic structures, bilateral trade intensity and business cycles synchronization; and indicated that in the long term, convergence of economic structures and trade growth are expected.
Darvas, Szapáry (2004)	HP filter (GDP)	Lithuania, Slovakia, Hungary, Estonia, Czech Republic, Latvia, Slovenia and Poland	They found significant increase in the synchronization of GDP in the EMU members since the start of the run-up to EMU; this lends support for the existence of OCA endogeneity.
Darvas, Vadas (2005)	Five different filters (GDP)	Lithuania, Slovakia, Hungary, Estonia, Czech Republic, Latvia, Slovenia and Poland	They found significant increase in the synchronization of GDP in the EMU members since the start of the run-up to EMU; this lends support for the existence of OCA endogeneity.
Nabil Ben Arfa (2012)	HP Filter (IP)	Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE	The study found no evidence of business cycle synchronization among GCC countries; instead it seems diverging business cycle.
Mkenda (2001)	G-PPP	Kenya, Tanzania and Uganda (EAC 3)	Found that EAC countries are having face similar external shocks and therefore indicating that they can form optimum currency area.
Buigut and Valev (2005)	SVAR	Kenya, Tanzania, Uganda, Rwanda and Burundi (EAC 5)	Found the contemporaneous macroeconomic shocks of EAC are mostly asymmetric, but suggested implementation of macroeconomic convergence policies would reduce the degree of asymmetry of shocks in the region.

Mburu (2006)	SVAR HP & BP filters (GDP)	Kenya, Tanzania, Uganda, Rwanda and Burundi (EAC 5)	Found the cross correlations of business cycles between the EAC countries are low and sometimes negative, and concluded that EA countries are not feasible currency area.
Opolot, & Osoro (2004)	RBC	Kenya, Tanzania, Uganda, Rwanda and Burundi (EAC 5)	Found less degree of business cycles synchronization among the block, and suggested further macroeconomic convergence strategies. But indicated some hope for EAC monetary union in the future.
Kishor and Ssozi (2011)	SVAR Kalman filter	Kenya, Tanzania, Uganda, Rwanda and Burundi (EAC 5)	Found less similarity of macroeconomic shocks in the region, indicating the formation of monetary union is not possible; but after the signing of the EAC treaty – in 999) – the degree of synchronization had improved significantly.
Mafusire and Brixiova (2012)	SVAR	Kenya, Tanzania, Uganda, Rwanda and Burundi (EAC 5)	They found relatively low degree of symmetry in the shocks affecting the region

3.4.2 Past Empirical Studies of BCS model

This section reviews the empirical studies of Business Cycle Synchronization analysis which is the second model used in this dissertation. The studies of business cycles and the international transmission of output shocks have a long history. Mitchell (1927) was the first to pioneer the business cycle analysis; he found positive correlation of business cycles across the countries he studies. This is known as the international transmission of business cycles. More recently, a greater number of studies were carried out on different aspects of business cycle synchronization. Campbell and Mankiw (1989) had assessed similarity of business cycles in G7 countries, and found no similar business cycles exist in the G7 countries. However, Lumsdain (1997) and Bayoumi, T., & Prasad (1997) employed a time varying weight technique to identify the common constituent of industrial production index and provided a proof of existence in international business cycles.

Canova and Marrinan (1998), had used a multi country model that assess interdependence of production and presence of a common disturbances that describes the cyclical dynamics of detrended output for Japan, Germany and USA. Gerlach (1988), examined synchronization of business cycles in countries under both periods of fixed and flexible exchange rate, he used monthly industrial production index to assess the cyclical dynamics and found the evidence of correlated world business cycle and output co-movements. Similarly, Baxter and Stockman (1989) did similar type of study by assessing synchronization of business cycle in a group of 49 countries, they used industrial production index as variable and finally arrived a conclusion that business cycles became more country-specific in the period after 1973.

Artis, Bladen-Hovell & Zhang (1995) evaluate the presence of European business cycle and its association to the global business cycle, they assessed industrial production index of 15 countries during the period before and after the creation of the European Exchange Rate mechanism (ERM). They found interlinked business cycles among the countries member of ERM, while contrarily, the interlinked business cycles of the ERM countries and that of the United States have weakened after ERM formation.

Kwan, C. M. (2009) studies business cycle synchronization among China and 10 trading partners selected from developed and developing countries in the period of 1971-2007, they found that there are no common factors explaining BCS among China and 10 selected countries. Moneta, F., & Rüffer, R. (2009) evaluated the degree and nature of business cycle synchronisation in East Asian countries. They estimated the cyclical dynamics of 10 East Asian countries using detrending techniques of output growth variable. They found synchronized business cycle all Asian countries considered, with the exception of Japan and China. The extent of business cycle synchronization had fluctuated over time; it also demonstrated an upward growth trend especially with the countries of newly industrialized economies.

Selover (1999) found evidence of international transmission of business cycles among the ASEAN countries using trade flows. However, there is little evidence of synchronization of ASEAN business cycle. Therefore, the suggestion of single currency by Goto and Hanada (1994) would not be a good idea. The impacts of business cycles among ASEAN countries might lead to some spillover effects. Basu and Taylor (1999) think that there is a perspective of an international and historical approach of the source and structures of business cycles. They find less economic volatility during the Bretton woods period and afterwards than during the gold standard and interwar period across fifteen developed countries. There are fewer fluctuations in business cycle nowadays

even with increasing international linkage across countries. The approach is robust enough to include the behaviour of economic and non-economic variables in the analysis of business cycles without restrictions.

Dibooglu (2000) investigated the sources of macroeconomic fluctuations since the classical gold standard. He concluded that monetary policy is interdependent and there is a lower incidence of monetary discretion under fixed exchange rates. This leads to increasing real demand policy effectiveness over time. The mean magnitude and dispersion of supply disturbances during the period of Bretton Woods are comparable to the one of the modern floating period. In contrast, the mean magnitude and dispersion of real demand shocks appear bigger than the Bretton Woods period.

Bayoumi and Eichengreen (1992) used a structural VAR to identify the incidence of aggregate supply and aggregate demand shocks in Western Europe and the United States. They divided the countries into seven geographical regions. Their findings suggest two plausible area of monetary unification between the core and periphery of the European Community (EC). The core countries at the centre of EC include France, Netherlands, Belgium, Germany, and Denmark and while the periphery comprises Greece, Ireland, Spain, Italy, Portugal, and the United Kingdom. The distinction of core-periphery disappears over time. The results in the US are very similar to the core periphery type found in Europe. In the US, the Mid-East, New England, Great Lakes, Plains, South East, South West constitute the core and periphery comprises the Rocky Mountains and the Far West.

Bayoumi and Eichengreen (1994) extended their study to include Asian and Latin America countries. They concluded that Asia countries are good candidates for small type of monetary agreement while no evidence of currency unifications is found for Latin-America countries. In another study by Frankel and Rose (1996) empirically tested their proposition endogeneity of OCA theory which indicates that the more countries integrate their trade tend the more they would have correlated business cycles. This correlation of business cycles indicates that these countries would experience symmetric shocks and less vulnerable to asymmetric shocks, leading to the supranational central bank to react shocks in an appropriate manner for all members of the currency union, thus, currency union would sustain and provide greater benefits for the members of monetary union. They conclude that in Europe cross-country shocks are more prevalent rather than cross-industry shocks.

Kim, Sunghyun & Wang (2003), following Frankel and Rose (1998) propositions, had assessed whether Asia-Pacific region have under gone synchronized business cycles or not. They found stronger business cycle synchronization between Hong Kong and China. In addition, they also reported that Asia-Pacific region in general had undergone increased business cycle synchronization, in which they explained due to worldwide capital flows. In spite of the fact that there is a growing literature on business cycle fluctuations elsewhere, there are a limited number of studies done on Africa. Cham (2007) studied the costs and benefits of currency union on West African countries, by suing business cycle synchronization method. In his study he concluded that, despite the obvious benefits of the monetary union, West African countries face significant challenges before the zone can become a full-fledged monetary union.

Mburu (2006) studied the feasibility and desirability of an East African monetary union using the synchronicity of business cycles and shocks, and he found that cross correlations of business cycles between EAC countries are low and sometimes negative, which leads to conclude — based on the synchronicity of business cycle criterion — that countries of the EAC do not form a feasible monetary area. A recent study by Kishor and Ssozi (2011) studied the business cycle synchronization of the five member countries of East African Community. In their study they found similar results to our study, in which they found relatively weak business cycle synchronization among the members of region, implying that formation of monetary union in the region is doubtful. But on the other hand, they found that the degree of business cycle synchronization of EAC countries had improved after the formation of the EAC treaty; in which we also found similar to this result.

3.5 Critiques Against Earlier Studies of MU in EAC

In the preceding section, it had presented a review of past empirical studies on the field of monetary union on East African Community. Based on that review, we had found two main critiques against the earlier studies of monetary union on EAC. Firstly, previous studies of monetary union in East African Community mainly depend on a limited number of OCA criteria to find out suitable candidates to form a monetary union. This thesis concentrates on evidences from the application of various OCA criteria in order to assess the feasibility of MU in EAC. This study extends the earlier studies of the traditional OCA analysis in EAC region by including analysis of factor mobility in EAC and product diversification in EAC.

Secondly, earlier studies on OCA in Africa or East Africa had mainly used bi-variate vector auto-regression methodology (2VAR model) for the examination of the asymmetric shocks in the region; this is too restrictive and may cause misleading (Han, 2009). This study extends to the earlier studies of SVAR model on East Africa by applying three variable vector auto-regression model to assess the economic shocks affecting the East African Countries, thus, it is the first to assess the similarity of underlying shocks in the EAC based on three variable VAR approach. The variables are world GDP growth, domestic GDP growth, and inflation.

CHAPTER 4

RESEARCH METHODS AND MODELS

This chapter discusses the methods used to analyze the feasibility of a Monetary Union in the East African Community (Tanzania, Uganda, Kenya, Rwanda and Burundi). Based on the economic theories of optimum currency area and business cycle, this chapter presents two econometric techniques to analyze the feasibility of a monetary union in the EAC. The first method is Structural Vector Auto-regression (SVAR) approach, premised on aggregate demand (AD) and aggregate supply (AS) framework. The second method is analysing the feasibility of a monetary union based on business cycle synchronization (BCS). Following the application of customary and contemporary techniques (SVAR & BCS) to study the feasibility of a monetary union in the EAC, the researcher would extend the earlier method of analysing by applying the ANOVA "analysis of variance" to determine the statistical significance of the differences between the means of different shocks and cycles of the EAC members.

The remainder of this chapter is organized as follows: section 4.1 briefly explains the research design, description and sources of data, discussion of the theory and methodology of the unit root tests (ADF & KPSS Unit Root Test). Section 4.2 is about the Symmetry of Shocks analysis using Structural VAR Model; it offers the theoretical framework of the SVAR Model, the identification strategy of supply and demand shocks, impulse response function test, and variance decomposition test. Section 4.3 contains a discussion on the convergence of business cycles using two widely used filters, namely Hodrick-Prescott and Baxter-King Ideal Band Pass Filter. The last section, section 4.4 presents a new approach of analysing the feasibility of a monetary union which is the one-way ANOVA. It starts with a brief definition and background of the One-Way ANOVA, followed by its assumptions.

4.1 Research Methodology

This section contains the general guidelines of research methodologies used in this study. It starts with a brief discussion on the research design of the study, followed by a description of the data and its sources, time series properties of the data, dummy variables used in the SVAR models, and lastly the determination of Lag Length and Normality.

4.1.1 Research Design

The main research design of this study is the exploratory research design which uses time series data. Figure 4.1 outlines the framework of analyzing the feasibility of a monetary union in the EAC. The figure displays the different ways of analysing the feasibility of a monetary union in the East African Community based on the OCA theory which is essential to understand the similarities or differences of the economic structures of the EAC countries.

Figure 4.1 displays the criteria to assess the costs and benefits of establishing a common currency area in light of the OCA theory. The OCA theory lays out two main approaches to analyse a monetary union; the first approach is to test whether the candidates' economies satisfy certain criteria such as factor mobility, openness, diversification of production, similarities of inflation, etc. If these criteria are satisfied by the candidates' economies, they would be considered eligible to form a monetary union. This approach is criterion-based and it is known as the traditional OCA approach. The second approach to analyse the feasibility of a monetary union is based on the cost-benefit approach to evaluate the optimality of a currency area. The costs of monetary union depend on how symmetrical the economies of a region are in terms of business cycles (HP & BP filters) and vulnerability to shocks (SVAR) (Alturki, 2007).

As shown in Figure 4.1, there are two options to analyse the feasibility of a monetary union in the EAC region. The first option is based on the traditional OCA approach which was discussed in chapter two and three. The second option is known as the New OCA approach which will be discussed in this chapter and the next chapter (V). In general, this research mainly follows the new OCA approach which evaluates the optimality of currency area based on the cost-benefit analysis.

In the New OCA approach, there are two sub-methods to judge the optimality of a currency area. The first method is by testing the symmetry of the underlying structural shocks. The second method is by studying the synchronization of the business cycle. The costs of giving up autonomous monetary policies depend on the similarity of shocks and synchronization of business cycles of the countries in the currency area. This means that if the countries have identical business cycles and experience identical or similar shocks, no individual economic policies are needed to cope with such shocks. In contrast, if the cycles and the shocks are idiosyncratic or asymmetric, individual policy responses would be appropriate.

The use of simple correlation analysis of shocks and cycles of the countries in a currency area is the customary way of analysing the feasibility of a monetary union in a particular region. For example, the more correlated the shocks and cycles between countries of a currency area, the less likely they are to lose by forming a currency area. This study goes beyond the customary way of analysis of the simple correlation coefficient; it proposes the use of one-way ANOVA procedure which can be used to test the equality of means and variances of the different shocks and cycles among EAC member countries. Figure 4.1 presents the overall picture of the research framework of this thesis.

In Figure 4.1, the subsection of 'New OCA approach' uses the Structural Vector Auto-regression model of Bayoumi and Eichengreen (1992) to extract the underlying shocks[3] of supply and demand in the region. After identifying the shocks, we measured their symmetry and asymmetry by using four different ways of analysis: 1) simple correlation analysis, 2) impulse response analysis, 3) variance decomposition analysis, and 4) one-way ANOVA (analysis of variance) and coefficient of variance analysis.

For model two of the business cycle, the study uses HP and BP filters to extract the business cycles. After extracting the trends and cycles, the study uses two alternative approaches to analyse the feasibility of a monetary union in a region. The first approach is the simple correlation analysis and the second approach is the one-way ANOVA (analysis of variance). If the cycles and trends between countries are positively correlated, the less likely they are to lose by forming a currency area. Also, for the ANOVA, if the cycles between countries are homogenous, countries in that region can form a monetary union.

[3] External global shock, domestic supply shock, domestic demand shock & domestic monetary shock.

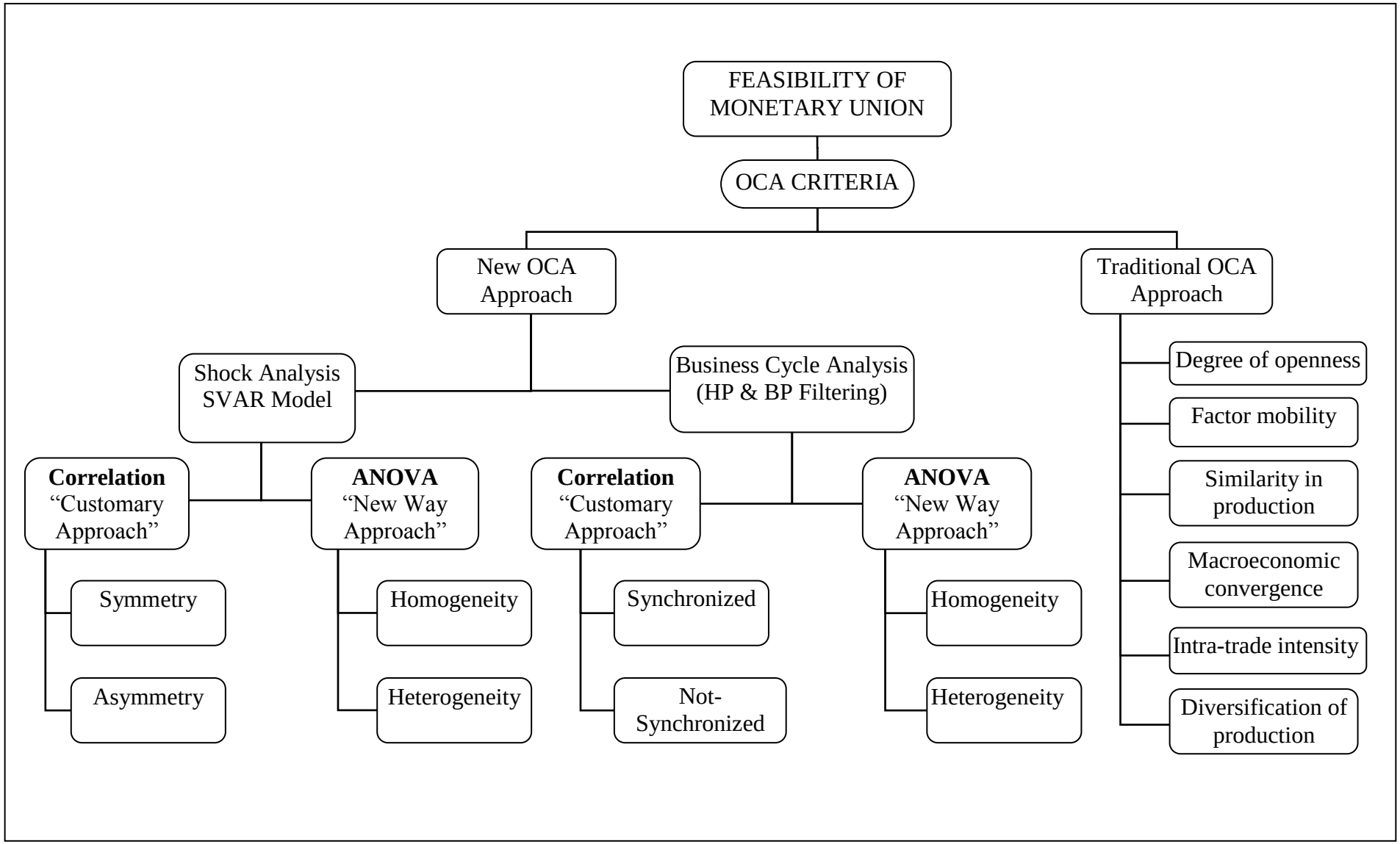


Figure 4-1: Research framework of the study

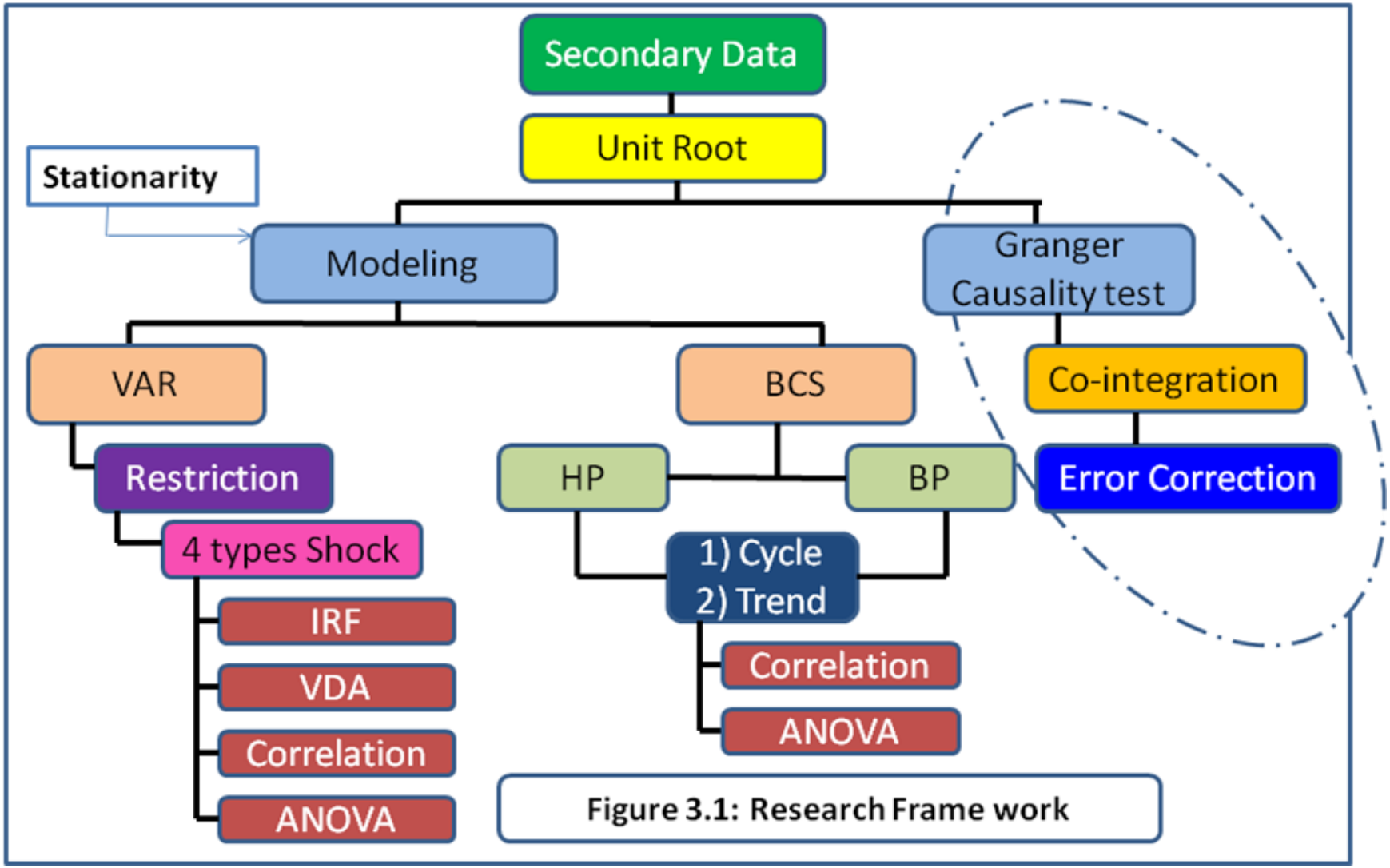


Figure 4-2: Analytical framework of the study

4.1.2 Data Description and Sources

This dissertation uses the annual data of the East African Community (EAC) member countries, namely Kenya, Uganda, Burundi, Rwanda and Tanzania. The major data sources used in this study were collected from the World Economic Outlook (WEO) database of the International Monetary Fund. The variables in the data included real gross domestic product (RGDP), GDP deflator and world real GDP, which is a proxy of world output. The GDP deflator was used as a price measure. It was calculated by using the formula of "current price GDP divided by constant price GDP" with the year 2000 as the base year. GDP deflator was considered as an alternate measure of inflation. For each country, growth and inflation were calculated as the first difference of the logarithm of real GDP, world GDP and the implicit GDP deflator.

4.1.3 Statistical Testing of Time Series Data

It is important for the data to be diagnosed before estimating the model so that it has the proper time series properties. This is achieved by testing the stationarity of the data before conducting further analysis. Diagnostic tests for unit roots were carried out to test the stationarity of the data series. The presence of unit root indicates that the series are not stationary. Stationarity is important because non-stationarity shows that the series have no long-run means; the variance & covariance are time dependent and not constant.

The following are the properties of stationary series:

Mean $E(y_t) = E(y_{t-s}) = u$ (5.1)

Variance $E\,[(y_t - u)^2] = [(y_{t-s} - u)^2] = \sigma^2{}_y$ (5.2)

Covariance $E[(y_t - u)(y_{t-s} - u)] = E[(y_{t-j} - u)(y_{t-j-s} - u)] = \gamma$ (5.3)

Where μ, σ^2_y, and γ_s, are all constants.

If the data series followed a random walk process, over time, the effects of shocks will not dissipate and the series will not revert to their long-run means. Thus, there is no meaningful relationship in the regression analysis of the series. The hypothesis testing based on *t*, F, chi-square test, etc. is likely to be suspected (Gujarati, 2008). The regression of the non-stationary series is said to be dubious. It exhibits high R^2 and *t* statistics although the series are independent of each other and thus it is without an economic meaning.

The presence of a unit root in the series makes the series exhibit the random walk process and non-stationary. Let a stochastic time series y_t defined as follows,

$$y_t = \rho y_{t-1} + u_t$$

Or alternatively written as

$$\Delta y_t = (\rho - 1) y_{t-1} + u_t$$

$$= \emptyset\, y_{t-1} + u_t$$

Where μ_t is a white noise error term with zero mean, constant variance σ^2 and serially uncorrelated. If $\rho = 0$ or $\phi = 1$ there is a unit root and the series, y_t is non-stationary. However, if $\phi = 0$, $\Delta y_t = (y_t - y_{t-1})\ \mu_t$ and since μ_t is purely random, the series in the first difference is stationary and is denoted by **I(0)**.

That is, a series is said to be stationary when it's first difference makes it stationary and denotes as I(0). If the series is non-stationary, it may be differenced more than once to become stationary such as I(1) (first difference of the first difference) or I(2) (second difference of the first difference). In general, in a non-stationary series, *y* is integrated of order *d* if it attains stationarity after being differenced *d* times, and this is denoted by y ~ I(d). If a series is stationary in levels, in this case $d = 0$ or y ~ I(0), the differencing is not necessary. The existence of a stationary relationship among the series indicates that are not independent but cointegrated.

Methodologies of Unit Root Test

There are many stationarity tests which can be applied to the data, including the Dickey-Fuller (DF) (1979) (1981) test, Augumented Dickey-Fuller (ADF) test, Phillips-Perron (PP) (1988) test and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) (1992). The most popular unit root tests are the DF, ADF and KPSS tests. These tests are based on the null hypothesis that a unit root is present in the series.

The DF and ADF are said to have superior small sample properties compared to other alternatives. Meanwhile, the non-parametric PP test statistics have been shown to have poor performance in small samples. Recently, the KPSS test of mean stationarity has been used to complement the ADF test. The reason is because some argue that the DF, ADF and PP tests tend to accept the null hypothesis too often and reversing the null hypothesis would help to overcome the problem. Hence, this study used the ADF and KPSS tests on the data.

1) Dickey-Fuller (DF) Test

Dickey and Fuller (1979) run their unit root test based on the following forms:

$$\Delta y_t = \vartheta y_{t-1} + \mu \qquad 5.4$$

$$\Delta y_t = \alpha + \vartheta y_{t-1} + u_t \qquad 5.5$$

$$\Delta y_t = \alpha + \beta t + \vartheta y_{t-1} + u_t \qquad 5.6$$

Where α is an intercept or drift term, t is a linear time trend and u_t is a white noise error term (zero mean, constant variance and serially uncorrelated). The presence of unit root term is measured by coefficient ϑ. If $\vartheta = 0$, the series contains a unit root. In each of the equation, the null hypothesis is $H_0 : \vartheta = 0$ versus the alternative hypothesis, $H_1 : \vartheta < 0$. The estimated value of ϑ is obtained by using the OLS. If the computed t-statistic of ϑ is smaller than the critical value computed by Dickey and Fuller, we do not reject Ho. Thus, there is a unit root and the series is non-stationary. The appropriate critical values for each of the equation above are τ, τ_u, and τ_τ, respectively. To avoid the potential serial correlation problem, higher order autoregressive process is introduced. The ADF test is a modified version of DF test; it is applied to the following model:

$$\Delta y_t = \alpha + \beta t + \vartheta y_{t-1} + \eta_i \sum_{i=2}^{p} \Delta y_{t-i} + u_t \qquad 5.7$$

$$\Delta y_t = \alpha + \vartheta y_{t-1} + \eta_i \sum_{i=2}^{p} \Delta y_{t-i} + u_t \qquad 5.8$$

$$\Delta y_t = \vartheta y_{t-1} + \eta_i \sum_{i=2}^{p} \Delta y_{t-i} + u_t \qquad 5.9$$

Where $\vartheta = -(1 - \sum_{i=1}^{p} \alpha_i)$, $\eta_i = \sum_{j=i}^{p} a_j$ and p is the number of lagged difference in dependent variable, introduces to filter serial correlation. If $\sum a_i = 1$ and $\vartheta = 0$, a unit root is present in the dependent variable. Inclusion of lagged dependent variables transforms the error terms into a white noise process. Again, the null hypothesis is H_o : $\vartheta = 0$ against the $H_1 : \vartheta < 0$. If the observed t — statistic is smaller than the critical value, we do not reject the null hypothesis of unit root.

The ϕ_i statistics provide by Dickey-Fuller (1981, p.1063) justify the characteristic of the system. To determine whether the system contains an intercept and/or a deterministic time trend, the null hypotheses of H_o : $\alpha = \beta = 0$, $\vartheta = 1$ and H0 : $\beta = 0,\ \vartheta = 1$ are tested using the ϕ_2 statistic and ϕ_3 statistic, respectively. To compute the ϕi statistic, equation (4.7) is treated as the unrestricted model and equations (4.9) and (4.8) are the restricted models in the ϕ_2 and ϕ_3 statistics, respectively.

$$\emptyset_i = \frac{(RSS_R - RSS_{UR})/\, r}{(RSS_{UR})/\, (T-k)}$$

Where RSS_R is the residuals sum of square of the restricted model, RSS_{UR} is the residuals sum of squared of the unrestricted model, r is the number of restrictions, while T and k are the number of observations and the number of estimated parameters in the unrestricted model, respectively. If the calculated ϕ_2 is $\geq$ the critical value, the null hypothesis of ϕ_2 is rejected. One or more of the parameters does not equal to zero. This implies that the data contains an intercept and/or a unit root and/or a time trend. If the null hypothesis is not rejected, the system is a random walk process. Similarly, if the calculated ϕ_3 is greater than the critical value, this suggests that the data contains a unit root and/or deterministic time trend.

In Stock and Watson (1989) the presence of deterministic components in the series is established from the significant of *t* statistics. Each series is regressed on a constant, time trend and a number of its own lagged and later checked for its *t* statistics on the trend variable. Insignificant *t* statistics suggest the series does not exhibit time trend. The similar regression is run against but dropping the time trend. Significant t statistics on a constant term suggest that the series has a drift.

2) Kwiatkoswaski, Philips, Schmidt, and Shin (KPSS) Test (1992)

The KPSS (1992) is a popular test that differs from the other unit root tests described in the above section. The KPSS tests the null hypothesis of stationary against a non-stationary alternative. The statistics is defined as follows,

$$\eta(u) = (T^{-2}) \sum_{t-1}^{T} \frac{S_t^2}{\sigma_k^2} \qquad where \qquad S_t = \sum_{i=1}^{t} e_i \quad t = 1, \ldots\ldots\ldots T \qquad 5.10$$

where e_i is the residual term from a regression of y_t on a intercept, $\sigma^2{}_t$ is a long-run variance estimate of yt, and T is the sample size. The statistics η(μ) has non-standard distribution and critical values have been provided. If unit root is present in the series the statistics η(μ) will be large and rejects the null hypothesis of stationarity.

4.1.4 Dummy Variables

In our modelling process, we added dummy variables in order to improve the fitness of the model as well to remove the impacts of outliers, thereby obtaining a better estimate of the residual (Doornik, et. al., 1998). Specifically, dummies were introduced to capture the high and unusual variation in the growth rate of GDP. Examples of this include the event of civil wars in Burundi and Rwanda in the early 1990s and the Ugandan civil unrest in the early 1980s. The Kenyan structural VAR differs from that of the other EAC countries since there was no dummy variable in the model. A dummy value of zero was assigned to the period when the event took place and for other periods, the dummy was assigned the value of 1. One example is in the event of the Burundian civil unrest.

Dummy_Burundi: 1 for period 1980 – 1991 and 1997 - 2010

Dummy_Burundi: 0 for periods 1992-1996.

4.1.5 Determination of Lag Length and Normality

In the unit root test, the number of lags included in the estimation is a crucial matter as it determines the results. If too many lags are included, the degree of freedom decreases and this reduces the power of the test to reject the null hypothesis. However, if too few lags are included, the actual behaviour of the variables will not be captured well. Therefore, careful attention must be paid to the selection of lag length.

According to *Banerjee et al.* (1993) too many lags is a less serious problem as it results only in loss in efficiency of estimation but too few lags would bias the results even in asymptotic distributions due to the present of autocorrelation. There have been many methods proposed to identify the appropriate lag structure, among others are Akaike's Information Criterion (AIC) by Akaike (1973), Schwarz-Bayes Information Criterion (SBC) by Schwarz (1978), Sim (1980), Said and Dickey (1984) and Campbell and Perron (1991) method. The Akaike's Information Criterion identifies the appropriate lag length based on the following formula:

$$AIC = T \log |\Sigma| + 2k$$

where $|\Sigma|$ is the determinant of the residuals variance/covariance matrix, T is the number of observations and k is the number of regressors. The Schwarts-Bayes Information Criteria (SBC) is based on

$$SBC = T \log |\Sigma| + k \log(T)$$

The Sim (1980) method uses likelihood ratio as follows:

$$X^2 = (T - c) (\log |\Sigma_{p1}| - \log |\Sigma_{p2}|)$$

where c is the maximum number of regressors in the unrestricted equation, $||\Sigma_{p1}|$ and $|\Sigma_{p2}|$ are the residuals the variance/covariance when the longest lags is p1 and p2, respectively, where $p1 < p2$.

In some studies, the Campell and Perron (1991) general-to-specific method is used in determining the number of lags for the dependent variable. Each equation is estimated with the longest lags on the dependent variable. If the last lag is not significant, the lags are reduced by one and re-estimated. This process continues until the lags are significant. Q-statistic is used as a guide to indicate that the selected lags are absent from autocorrelation problem. A common lag length is imposed on VARs.

Normality

It is important assumption that the residuals in the SVAR model should be normally distributed with the mean of zero, otherwise the p-values associated with the coefficients are unreliable. Thus, to test the normality assumption we used the the Jarque-Bera (1981) test.

$$\chi_n{}^2(2) = n\left(\frac{1}{6}b_1 + \frac{1}{24}(b_2 - 3)^2\right)$$

where Skewness = $\sqrt{b_1}$ $= \frac{m_3}{m^{3/2}{}_2}$; Kurtosis = $\frac{m_4}{m^2{}_2}$;

$$m_k = \sum_{t=1}^{n}(x_t - \hat{x})^k/n \qquad \text{k = 2,3,4}$$

When the data is normally distributed the value of kurtosis is 3 while the value of skewness is zero. The Jarque-Bera statistics follows the chi-squares distribution with 2 degrees of freedom. The above can be written alternatively as

$$\chi_n{}^2(2) = n\left(\frac{u^2{}_3}{6u^2{}_3} + \frac{1}{24}\left(\frac{u_4}{u^2{}_2} - 3\right)^2\right) + n\left(\frac{3u^2{}_1}{2u_2} - \frac{u_3u_1}{u^2{}_2}\right)$$

where,

$$u_k = \sum_{t=1}^{n} e^k{}_t\ /n \qquad (5.11)$$

The null hypothesis is residuals are normally distributed. If the *p* value of the computed chi-squares statistics is very small rejects the normality assumption.

4.2 Symmetry of Shocks Approach: Structural VAR Model

In this model, we assessed the empirical suitability of a monetary union for the East African Community members. The Structural Vector Auto-regression (SVAR) method was used to identify the underlying shocks of a four-variable VAR model across the East African economies. SVAR model helped us to identify whether EAC countries are having symmetric or asymmetric shocks which is an essential element in the determination of the Optimum Currency Area.

4.2.1 Identification Strategy of Supply and Demand Shocks

Before we discover the incidences of supply and demand shocks, we need to specify the identifying assumptions in the SVAR model. Thus, the study follows the identification scheme of Bayoumi and Eichengreen (1992; 1994), with some extension in variables in order to identify the different types of shocks affecting East African Community. Therefore, in line with the OCA predictions, we used a four-variable SVAR model to examine the underlying shocks affecting the EAC region. The variables used were global real GDP (y*), country specific real GDP (y), real exchange rate (e) and domestic price level (p). Therefore, we can write the structural model as follows:

$$X_t = A_0 \in_t + A_1 \in_{t-1} + A_2 \in_{t-2} + \ldots = A(L) \in_t$$

$$\Delta y^*_t = A_{11}(L) \in_t^{s*} \quad (4.13)$$

$$\Delta y_t = A_{21}(L) \in_t^{s*} + A_{22}(L) \in_t^{s} + A_{23}(L) \in_t^{d} + A_{24}(L) \in_t^{m} \quad (4.14)$$

$$\Delta e_t = A_{31}(L) \in_t^{s*} + A_{32}(L) \in_t^{s} + A_{33}(L) \in_t^{d} + A_{34}(L) \in_t^{m} \quad (4.15)$$

$$\Delta p_t = A_{41}(L) \in_t^{s*} + A_{42}(L) \in_t^{s} + A_{43}(L) \in_t^{d} + A_{44}(L) \in_t^{m} \quad (4.16)$$

Where $X_t = [\Delta y^*_t, \Delta y_t, \Delta e_t, \Delta p_t]'$; comprising of global real GDP (y*), country specif real GDP (y), real exchange rate (e) and domestic price level (p), which are all expressed in log difference form. The matrix A_i is a 4x4 matrix that represent the impulse responses of endogenous variables to structural shocks. $\in_t = [\in_t^{s*}, \in_t^{s}, \in_t^{d}, \in_t^{m}]'$, comprising of external global supply shock ($\in_t^{s*}$), country specific supply shock ($\in_t^{s}$), country specific demand shock ($\in_t^{d}$) and country specific monetary shock ($\in_t^{m}$) respectively, which are assumed to be serially uncorrelated, and are orthonormal.

To identify the structural shocks, we impose the following long run restrictions: i) global GDP is considered to evolve exogenously so that country specific supply, country specific demand and country specific monetary shock do not affect world real GDP in the long run. Thus, our restrictions would $A_{12} = A_{13} = A_{14} = 0$. ii) In the long run country specific real GDP is affected exclusively by supply shocks, thus, the restriction equation would be $A_{23} = A_{24} = 0$. ii) Monetary shocks do not have effects on real exchange rates in the long run.

These restrictions can be rewritten in the following matrix form:

$$\begin{bmatrix} \Delta y_{t*} \\ \Delta y_t \\ \Delta e_t \\ \Delta p_t \end{bmatrix} = \sum_{i=0}^{\infty} \begin{bmatrix} A_{11\,i} & 0 & 0 & 0 \\ A_{21\,i} & A_{22\,i} & 0 & 0 \\ A_{31\,i} & A_{32\,i} & A_{33\,i} & 0 \\ A_{41\,i} & A_{42\,i} & A_{43\,i} & A_{44\,i} \end{bmatrix} \begin{bmatrix} \in^*_{s\ t-i} \\ \in_{s\ t-i} \\ \in_{d\ t-i} \\ \in_{m\ t-i} \end{bmatrix} \qquad (4.19)$$

Given the above restrictions, the structural shocks can be recovered as linear combinations of reduced-form innovations and they are serially uncorrelated and orthonormal. In places relevant, we compared the identified East African shocks to the existing monetary unions such as European Monetary Union, Gulf Co-operation Council GCC and some other monetary unions.

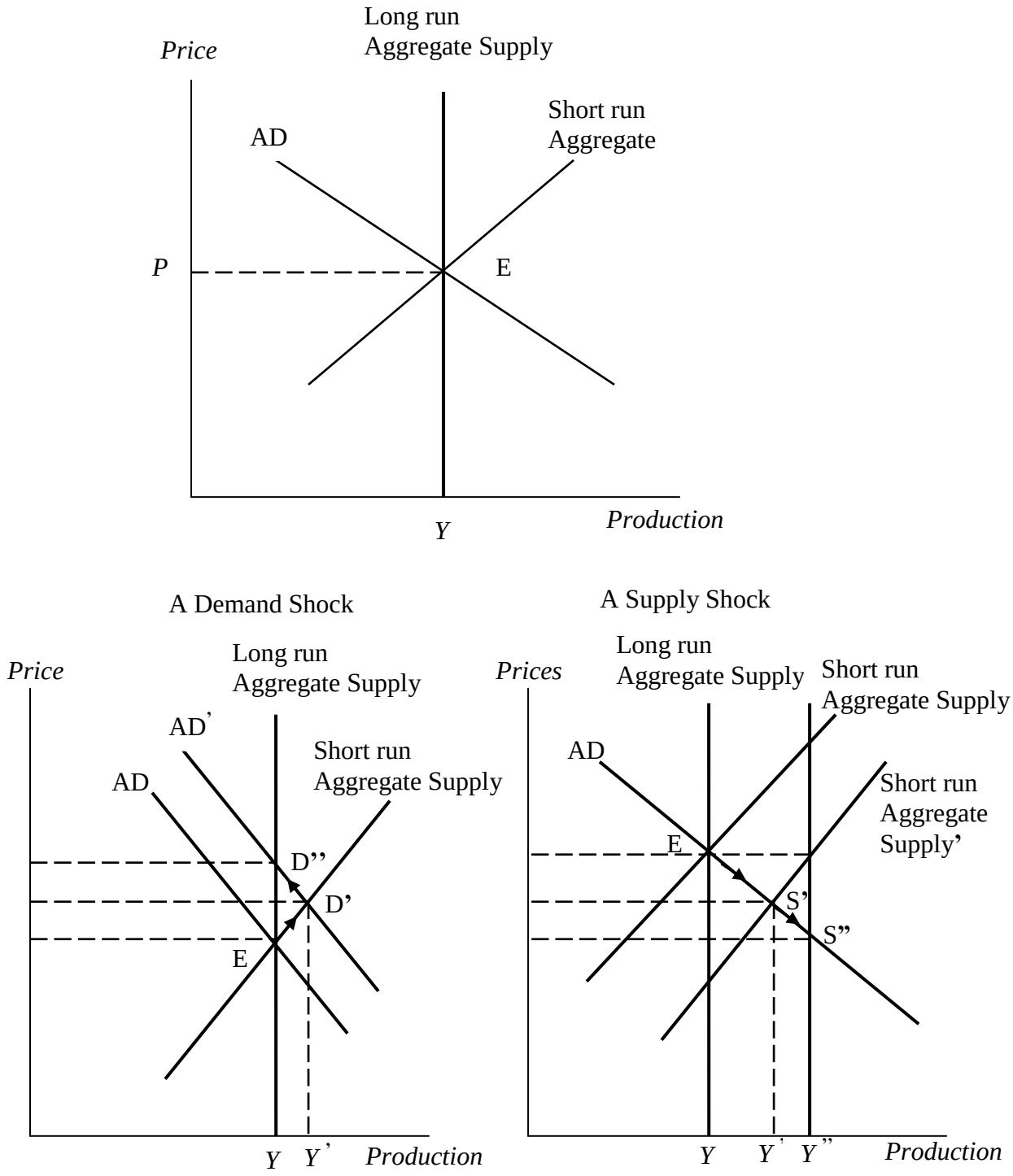


Figure 4-3: The aggregate supply and aggregate demand model

4.2.3 Impulse Response Function Test

Impulse response function (IMF) is a device that helps us learn the dynamic properties of vector autoregressions of interest to forecasters. This test determines the responsiveness of the dependent variables in the SVAR to the corresponding shocks of each variable. In other words, a unit shock is applied to the error for every variable in the equation to identify the effect of shocks upon SVAR over time. Therefore, if there are *k* variables in a system, a total of k^2 impulse responses could be generated. The way that this is achieved in practice is by expressing the SVAR model as a vector autoregressive model. When SVAR models are stable, the shock should gradually decapitate (Brooks, 2008).

Let us assume that Y_t is a *k*-dimensional vector series created by

$$Y_t = A_1 Y_{t-1} \pm \cdots + A_p Y_{t-p} + U_t$$

$$= \Phi(B) U_t = \sum_{i=0}^{\infty} \Phi_i U_{t-i} \qquad (5.24)$$

$$I = \left(I - A_1 B - A_2 - \ldots - A_p B^p\right) \Phi(B) \qquad (5.25)$$

where $cov(U_t) = \sum$, Φ_i is the moving average coefficients that calculates the impulse response. More specifically, $\Phi_{jk,i}$ stand for the response of variable *j* to unit impulse in variable *k* occurring *i*-th period ago. Interpretation of the IRF is straightforward, if the innovations $\in_t$ are contemporaneously uncorrelated. The *i*-th innovation $\in_{i,t}$ is simply a shock to the *i*-th endogenous variable $y_{i,t}$. Innovations are usually correlated, and may be viewed as having a common component which cannot be associated with a specific variable (Saatcioglu & Korap, 2006). Impulse response function analysies are used to evaluate the usefulness and effectiveness of a policy change (Lin, 2006).

4.2.4 Variance Decomposition Test

Variance Decomposition analysis is used to identify the contribution of each shock in explaining variations of the other variables in the Structural Vector Auto-Regression models. Variance decomposition analysis provides a somewhat different means for explaining the dynamics of a SVAR model. This test exhibits the proportion of movements in the dependent variables that are due to their 'own' shocks, versus shocks to the other variables. A shock to the i th variable will directly explain the effect of variable that would be transmitted to all of the other explanatory variables in the system through the dynamic structure of the VAR.

The variance decomposition analysis provides information on how much of the h-step-ahead forecast error variance for each given variable is explained by the innovations to each explanatory variable for h = 1, 2 ... In practical, most of the time it is customary to observe that own series shocks explain most of the forecast error variance of the series in a SVAR. To a certain extent, variance decompositions and impulse response functions provide similar information but they do so in slightly different ways (Mitze, 2011).

The variance decomposition test presents a table format that displays separate variance decomposition for each explanatory variable. The 1st column, labelled "period" refers to the *h*-step-ahead forecast error variance of the variable *i-th* (in this case, we reported *i* until the 20^{th}). The second column, labelled "S.E.", provides information on the forecast error of the variable at a given *h*-step-ahead forecast horizon. The forecast error is the variation in the current and future values of the shocks to the explanatory variable in the system (SVAR). The remaining columns show the percentage of the forecast variance due to each innovation, with each row adding up to 100 (QMS, 2004).

4.2.5 Merits of the Adaptation of the Current Method

Over the last three decades, Structural Vector Autoregressive (SVAR) models have become an important research tool that is widely used in the applied macroeconomic analysis as well as monetary union analysis. SVARs provide fruitful insights on the interrelations between macroeconomic variables. The main importance of SVAR as opposed to the traditional VAR is that in structural vector auto regressions (SVARs), 'theoretical' restrictions are imposed to identify the underlying shocks. As discussed in earlier sections, the OCA theory has pointed out the importance of similarity in demand and supply shocks for members of a monetary union. Structural Vector Auto regression model is used to extract the underlying demand and supply shocks among East African economies. In this respect, SVAR would give a clear understanding on whether or not future members of a currency union are able to form a monetary union.

There are several key methodologies for testing the feasibility of monetary union in a region, and among the popular methods are the following: (i) Analysis of macroeconomic economic shocks effecting a region using SVAR (Structural Vector Autoregression), (ii) Analysis of synchronization of business cycle, (iii) G-PPP (Generalized Purchasing Power Parity) Analysis, (iv) Trade Effects (Gravity Model), and (v) DSGE (Dynamic stochastic general equilibrium modelling) etc. Some of the above mentioned techniques for analyzing a monetary union have drawbacks and do not provide a clear conclusion of whether a successful monetary union is feasible. For example, one critique of the Generalized-PPP model is that movements in the macroeconomic variables do not distinguish disturbances from responses (S. K. Buigut & Valev, 2005b). As for the Gravity model, the critique is that the theoretical justifications of the model are subject to some dispute (Adams, 2005).

Drawing from the OCA theory and the experience of the European Monetary Union, "symmetry of shocks – SVAR" and "synchronization of business cycle" are among the popular methods to analyse the suitability of a monetary union in a region. Over the past decade, there has been significant progress in the specification and estimation of the contemporary macroeconomic analysis. The progress in econometrics, statistics and computer technology spurred the introduction of dynamic stochastic general equilibrium modelling (DSGE) which seems to be a relatively attractive methodology and has been used in different fields (Tovar, C. E. 2009). However, DSGE analysis is a highly complicated process, since it is reliant on detailed economic data which makes it currently unsuitable to be applied in Africa where such data is scarce (K.A. Sheikh et al., 2011). Thus, the research on DSGE models can be addressed in future studies.

The Structural Vector Auto regression model (SVAR) is a method that is widely used to determine whether future members of a monetary union can form an Optimum Currency Area. This method assesses the similarities of a broad range of OCA properties[4] available in a geographical domain; it finds out subsets of groups that have similar characteristics which might make it more appropriate for them to have a common currency (Alturki, 2007). This method can assess the degree of symmetry of shocks and the speed at which the economies adjust to the shocks.

4.2.6 Constraints of Adopting the Current Method

Despite the importance and dominance of structural vector autoregressive (SVAR) models in the research arena, they are still subject to some constraints and shortcomings. The following are major limitations of the SVAR that are available in the literature:

[4] Traditional OCA properties include: diversification of production, price & wage flexibility, openness, factor mobility, similarity of production & inflation rate etc

i. SVAR models have more parameters and this is known as the "curse of dimensionality".
ii. SVAR models use impulse response analyses which are associated with uncertainty.
iii. There exists a lack of identification of the imposed causal ordering of the variables of the system.
iv. The study used yearly data, when in fact quarterly data series would be more desirable to produce a better outcome as annual data series may not pick up some short-run interactions that occur within a year.

4.3 Business Cycle Synchronization Approach

This is the second method of analysing the viability of monetary union for the EAC members. Business cycle synchronization refers to the degree of co-movements of the fluctuations across economies and time; it checks whether a group of countries are affected by common fluctuations. Business cycle synchronization is therefore considered as a sign of an optimum currency area. De-trending techniques are used to compute cyclical output.

4.3.1 Measures of Business Cycle Synchronization

This study attempts to explore the degree of business cycle synchronization between EAC member countries to quantify the costs and benefits of monetary union for EAC members. Real GDP will be used to derive business cycles since it avoids fluctuations due to changes in the price level of a particular country (Kwan, 2009). Based on this method, we tried to determine the nature of the business cycle relationship among the EAC member countries. Results drawn from this analysis would inform us about the optimality (or non-optimality) of a potential monetary union of the EAC. Business cycle synchronization among EAC countries is examined by the following methods.

The most direct and easiest way to examine business cycle synchronization is to compute the correlations of real GDP growth rates. However, the standard and more accurate measure of business cycle synchronization is by evaluating bilateral correlations of detrended real GDP between the EAC countries. Detrended real GDP takes out the long-term trend components from real GDP, eliminating their effect on the real GDP correlations. Following detrending, visual inspection would be carried out on different graphs of the business cycle, and subsequently a correlation test would be conducted on contemporaneous unconditional correlation between the business cycles of the EAC member countries at different time periods.

4.3.2 The De-trending Methods (Hodrick-Prescott & Band-Pass Filter)

The two leading approaches to remove trends from macroeconomic time series are Hodrick-Prescott filter (HP) and the Band-Pass filter (BP), and they are slightly different in terms of the filtering methods adopted (Canova, 1998). These filters are designed to eliminate the influence of cyclical variation at various frequencies; in other words, they transform the data into mean-zero covariance stationary stochastic process. Canova (1998) studied the business cycle of the United States using different filters and found that different detrending methods extract different types of information from the data. Thus, in order to make our results more robust, we used and compared the results of these two most widely adopted filters in the literature -the Hodrick-Prescott filter (HP) and the Band-Pass filter (BP) (Z. Darvas & Szapáry, 2008).

(a) Hodrick-Prescott

The Hodrick-Prescott (HP) filter was introduced to estimate business cycles. This filter is a very popular and successful method in the empirical literature of business cycle theory; it provides information on the timing of expansionary and contractionary phases. Hodrick and Prescott suggest decomposing the series y_t in a cyclical (temporary) and trend (permanent) component by the help of the following minimization:

$$\underset{\tau}{Min} \sum_{i=1}^{T} (y_i - \tau_i)^2 + \lambda \sum_{i=2}^{T-1} (\Delta \tau_{i+1} - \Delta \tau_i)^2 \qquad (5.26)$$

τ_i is a degree of adjustment that measure the trend component and λ is an ad-hoc term that reduces the acceleration of trend.

The 1st term provides information about the differences between the original series, y_i, and the trend, τ_i, which is interpreted as the degree of adjustment. The 2nd term provides information about the degree of variability by means of the second differences of the trend, τ_i. This is usually interpreted as a measure of smoothness. The parameter λ reduces the acceleration of the trend. It determines the weight of fitness relative to the smoother. The trend will be more flexible when the value of the parameter is small. Similarly, the trend will be less flexible when the value of the parameter is high. In the same way, the trend will be less flexible when the value of the parameter is high. If the value of λ is zero, the original series and the trend are equal, which means that there are no cycles or noise in the original series, or $y_t = \tau_i$. For yearly data, which is the case of our data, we retains a value of $\lambda = 100$.

The data used for this analysis are yearly data from the World Bank and IFS databases. However, the use of the HP filter has a drawback, since it removes a trend from the series at a cost of shifting peaks and troughs, increasing the volatility of the differenced series (Baxter and King, 1999). Therefore, in this study, another filter was used for the purpose of studying the business cycle synchronization in the EAC and compared to the HP filter.

(b) Baxter and King

The Baxter-King Ideal Band Pass Filter (BK or BP) is applied to enhance the analysis of EAC business cycles and compare it with the cycles identified by the Hodrick-Prescott filter. Similar to HP filter, the Baxter-King ideal band pass isolates the components of GDP series. The difference between the two filters is that the BK filter calculates the components of GDP that lie within a given range. The specification of this range is based on economic theory and prior assumptions about the duration of the business cycles.

For instance, it is widely believed that business cycles last between 2 and 8 years. Thus, the lower band can be set at 2 years and the upper band at 8 years. In doing so, low frequency is removed and the high frequency of the cyclical components is smoothed. Furthermore, the BK filter requires a moving average of infinite. For this study, the moving average is approximated and set to 3 years. In general, the two filters show considerable similarities of the cycle components of GDP. Due to the way it is constructed, the BK filter does not pick the cycles that occur in the early or late periods in the sample.

4.3.3 Adaptation of Current Method

Some of the aforementioned techniques of analyzing a monetary union have drawbacks and do not provide a clear conclusion of whether a successful monetary union is feasible. This method of business cycle synchronization analysis is widely used in the OCA (optimum currency area) literature as a tool to determine whether future members of a monetary union face correlated trend and cyclical components of their macroeconomic indicators such as GDP.

The OCA theory stresses the significance of business cycle synchronization analysis for the future members of a monetary union since it gives a clear understanding on whether future members of a currency union would be able to form a monetary union. This method is called meta analysis since it assesses the similarities of a broad range of OCA properties of a group of countries; it finds out subsets of countries that have similar characteristics and may therefore be more suitable for monetary union (Alturki, 2007). This method can assess the correlation of cycles and trends between countries and regions (J. Fidrmuc & Korhonen, 2006; Shin & Wang, 2003).

This method is also instrumental to understanding the effects of international trade on the countries which intend to form a single currency area (Gruben et al., 2002; Kose, Prasad, & Terrones 2003). Unlike other methods of analyzing the monetary union, this method can accommodate the data set which is easy to obtain and analyze, and this is why business cycle synchronization analysis is a widely used method used to study monetary unions.

The OCA theory, which is a tool for analyzing the viability of a monetary union in a particular region, argues that the costs of using a common currency depend on how symmetrical the economies are in terms of business cycles (Alturki, 2007). If the permanent and temporal components of two countries present opposite phases, the cost of their participation in a monetary union would be much higher in comparison to the benefits of their participation. On the contrary, if the economies of these countries experience the same phase, the cost of their participation of monetary union is outweighed by the benefits induced by the common currency (Filis et al., 2010).

4.3.4 Constrains of Adopting the Current Method

There are not that many criticisms and constraints of this method, and the following points would highlight some of them. Instead of using gross domestic product, it would be better to use the industrial production index (IPI) and unemployment rate which are common business cycle indicators. As Artis et al. (2004) and Camacho et al. (2006) argue, industrial production index is better than the GDP indicator because IPI displays more cyclical sensitivity than the GDP as well as provides more information about the monitoring of business cycles compared to the GDP. Nonetheless, the problem is the unavailability of data on the industrial production indexes for the EA Countries.

4.4 Homogeneity of Variance

The purpose of this section is to apply the logic of one-way analysis of variance (ANOVA) to the analysis of monetary union. This section is an extension of the two previously mentioned methods of analyzing the feasibility of monetary union (symmetry shocks and synchronization of business cycles). Thus, this method of analysis would be a contemporary approach of studying the feasibility of monetary union.

ANOVA can be used to test the equality of means and variances of shocks & cycles between the EAC countries. As the OCA theory suggests, countries with similar economic structures can be expected to have similar business cycles and symmetric shocks. Therefore, it is useful to determine whether there are mean differences in the different shocks and business cycles of the EAC countries. If we found that the EAC economic shocks and business cycles are different, we proceeded to post hoc tests to determine which specific groups differ significantly from one another.

4.4.1 Analysis of Variance (One-way ANOVA)

Analysis of Variance is a useful technique to compare the means of several groups. A simple one-way classification is an extension of the student's *t* test on more than two groups. This ANOVA method is a flexible tool with various uses; it was originally developed by RA Fisher in the 1920s and has a wide application in diverse fields. However, this study would be the first to apply this method in monetary union scenarios.

ANOVA is very popular in experiments where the objective of the researcher is to compare differences between two groups (control group and experimental group). Similar to that, we examined the mean differences of underlying macroeconomic disturbances among the East African countries (demand shock, supply shock, monetary shock and as well business cycle and trends). ANOVA uses the mean, variance and a table of critical values for "F" Distribution to calculate the "F" value. Notation of the ANOVA table is provided in Table 5.1 below.

Table 4-1: ANOVA table

#	Source of variation	Degrees of freedom	Source of squares	Mean sum of squares	F ratio or variance ratio (df)
i	Groups	$k-1$	$\sum_i (x_i - \ddot{x})^2 = \left(\sum_i x^2{}_i - T^2/N\right)$	$S^2{}_B = \frac{\sum_i (x_i - \ddot{x})^2}{k-1}$	$\frac{S^2{}_B}{S^2{}_w}(k-1, N-k)$
ii	Within groups	$N-k$	$\sum_i \sum_j (x_{ij} - \ddot{x}_i)^2 = \sum_i \sum_j x^2{}_{ij} - \sum_i (T^2/n_i)$	$S^2{}_w = \frac{\sum_i \sum_j x^2{}_{ij} - \sum_i (T^2/n_i)}{N-1}$	
	Total	$N-1$	$\sum_i \sum_j (x_{ij} - \ddot{x}_i)^2 = \sum_i \sum_j x^2{}_{ij} - \sum_i (T^2/N_i)$	$\frac{\sum_i \sum_j x^2{}_{ij} - \sum_i (T^2/N)}{N-1}$	

df = degree of freedom

4.4.2 Assumptions for Underlying Analysis of Variance

There are certain assumptions involved in the one-way analysis of variance; if these assumptions are fulfilled, our results and analysis are reliable. One assumption is that the variables under investigation are normally distributed in the population from which the samples are drawn. It is also assumed that the variances in the populations from which the samples are drawn are equal; as in the case of the t-test, this assumption is referred to as the homogeneity of variance. Finally, it is assumed that all data entries in the study are randomly and independently drawn from the population. In practice, at times the data do not entirely satisfy these assumptions, in such cases, a non-parametric test should be considered as an alternative procedure (post hoc test).

Typical Hypothesis for ANOVA:

The null hypothesis tested by one-way ANOVA is that two or more population means are equal. For example, we can say the following:

1. There is no difference in the average economic shocks & business cycles of the five EAC member countries.
2. There is a difference in the average economic shocks and business cycles of the five EAC member countries.

Statistical Hypotheses

H_0 : the k population means are equal

H_a : the k population means are not all equal

The decision rule: the rejection or acceptance of the statistical significance of the differences in two or more means is based on a standard that no more than 5% of the difference is due to chance or sampling error, and that the same difference would occur 95% of the time should the test be repeated. Some researchers use a more rigorous standard of 1%, and that the same difference would occur 99% of the time should the test be repeated.

CHAPTER 5

RESULTS AND ANALYSIS

This chapter reports and discusses the empirical results of the study; it evaluates the prospects of a monetary union in East African Countries based on the incidence of shocks affecting EAC member countries. The results and discussions were grouped into two main econometric techniques used to assess whether EAC countries face similar disturbances. The first approach is based on Structural Vector Autoregression model and the second model is based business cycle synchronization approach. The organization of the chapter is as follows: it begins with the statistical properties of the data, unit root test and stability test of the models. Then it proceeds to the findings and analysis of SVAR model, covering correlation analysis of the disturbances, the size of impulse response, variance decomposition analysis and lastly it provides findings and discussion of Business Cycle using Hodric-Prescott and Band-Pass filters. The dynamics of the permanent and transitory components of EAC countries would be discussed.

5.1 Econometric Procedures

In econometric modelling and time series data, it is essential to diagnose both the unit root test and stability test of the models. Thus, we start our analysis by studing the unit root tests, to see whether the data is stationary or not. In the second subsection we use some diagnostic and stability tests; if the models pass these diagnostic tests we proceed to use the model but if the model does not pass some of the tests we improve the specification of the model. Thus, we would cover the following tests, Eigenvalue stability condition, lag order selection criteria, miss-specification test etc.

5.1.1 Unit Root Tests

The variables were screened for unit root problems using Kwiatkowski-Phillips-Schmitt-Shin (KPSS) and Augmented Dicky-Fuller (ADF) test statistics; the variables were in the level (in logarithm) and change (first difference) of global output, country specific GDP and GDP deflator. Table 5.1 provides the results of the Kwiatkowski-Phillips-Schmidt-Shin (KPSS test statistics and the Augmented Dickey-Fuller (ADF)) test statistics. Since the Augmented Dickey-Fuller test is susceptible to the lag length used in the test, we use Schwartz Information Criterion (SIC) procedure to choose the suitable lag length in the ADF test. The null hypothesis of the Augmented Dickey-Fuller (ADF) test is that there is a unit root problem in the series.

The Augmented Dickey-Fuller (ADF) test statistic shows that the null hypothesis of a unit root cannot be rejected at the logarithm level for the data series of all the five countries covered in this study at 5 percent significance level (with the exception of GDP deflator of Uganda which is not rejected at 10 percent significance level). But after differencing the data, the ADF test statistics shows that the variables are stationary at 5 percent significance level. Stationarity is a necessary condition and it makes use of VAR models appropriate while non-stationary data is inappropriate to use for modelling and it can lead to spurious regressions (Brooks, 2008). On the other hand, to double check the time series properties of the data; KPSS test was used. The KPSS test is another way of testing unit root problems and it is considered to be complementary to the ADF test. The KPSS (1992) test is different from the other existing unit root tests, because in KPSS the series is supposed to be stationary under the null; on the other hand, KPSS test statistic is formed on the residuals from the OLS regression of y_t on the exogenous variables x_t. KPSS considers the null hypothesis of a stationary series against the alternative of non-stationary or unit root problem.

According the study results in Table 5.1, the KPSS test statistics confirms the results of the ADF test. That is, the null hypothesis of all the series used in the study is rejected at the log level at 10 percent significance level. However, the null hypothesis is accepted for all the series at the first differences at the significance level of 10 percent. The acceptance of the null hypothesis of the KPSS test makes the use of a VAR model in first differences appropriate. In summary, the study data has good properties of consistency and asymptotic normality, thus, we can proceed for further analysis.

Table 5-1: ADF and KPSS unit-root tests: EAC data

	Augmented Dickey-Fuller (ADF) H_0: Unit Root				KPSS Test H_0: Mean Stationary			
Series	*Level*		*Difference*		*Level*		*Difference*	
	k	τ_μ	k	τ_μ	k	η_μ	k	η_μ
Burundi								
Sample 1980-2010								
World GDP	0	-0.009	0	-3.533[a]	4	0.711	1	0.079[a]
Burundi GDP	1	-0.942	0	-4.081[a]	4	0.364	3	0.176[a]
Burundi GDP deflator	0	2.040	0	-4.308[a]	4	0.716	1	0.505[b]
Kenya								
Sample 1980-2010								
World GDP	0	-0.009	0	-3.533[a]	4	0.711	1	0.079[a]
Kenya GDP	1	-0.226	0	-3.372[b]	4	0.725	1	0.111[a]
Kenya GDP deflator	1	-1.103	0	-2.635[c]	4	0.724	4	0.183[a]
Rwanda								
Sample 1980-2010								
World GDP	0	-0.009	0	-3.533[a]	4	0.711	1	0.079[a]
Rwanda GDP	0	-0.152	0	-4.979[a]	4	0.472	0	0.208[a]
Rwanda GDP deflator	0	0.517	0	-4.530[a]	4	0.712	2	0.131[a]
Tanzania								
Sample 1980-2010								
World GDP	0	-0.009	0	-3.533[a]	4	0.711	1	0.079[a]
Tanzania GDP	1	0.934	2	-2.748[c]	4	0.713	4	0.458[c]
Tanzania GDP deflator	4	-2.823	0	-3.713[a]	4	0.693	4	0.423[c]
Uganda								
Sample 1980-2010								
World GDP	0	-0.009	0	-3.533[a]	4	0.711	1	0.079
Uganda GDP	0	2.615	0	-2.893[b]	4	0.712	4	0.458[c]
Uganda GDP deflator	2	-2.794[c]	6	-4.915[a]	4	0.604	4	0.530[b]

Note: a, b and c represent significant level at 1 percent, 5 percent and 10 percent respectively.

5.1.2 Diagnostic Test (Stability Test)

For diagnostic testing, the R-square in each of our parsimonious VAR models were high; thus, it indicates that variables included in the regression model can be explained by much of the variations in the model. All the variables are both individually and jointly significant as indicated by the F and t statistics. The VAR model estimates do not provide the p-values for testing the corresponding parameters, but, we can understand from the t-statistics, it is easy to decide whether or not a lagged independent variable has a significant effect on the corresponding dependent variable, by using a critical point of $t_0 = 2$ or 1.96. For instance, if $|t_0| > 2$, or 1.96, then it can be concluded that the corresponding independent variable has a significant adjusted (partial) effect on the dependent variable (Agung, 2009).

Table 5-2: SVAR miss specification tests for EAC members

SVAR Model for	Jarque-Bera test	Q-Statistics		
		Y*	Y	P
Burundi	5.718619	12.162	10.940	6.5282
	(0.4554)	(0.204)	(0.280	(0.686)
Kenya	8.284838	10.735	10.300	12.540
	(0.2180)	(0.294)	(0.327)	(0.185)
Rwanda	27.23242	10.139	11.357	2.8324
	(0.0001)	(0.339)	(0.252)	(0.971)
Tanzania	5.663227	9.3047	9.5919	9.6574
	(0.4620)	(0.410)	(0.385)	(0.379)
Uganda	6.810824	11.747	6.1170	16.110
	(0.3387)	(0.228)	(0.728)	(0.065)

Y* = Global GDP; Y = domestic real GDP; and P = domestic price level
Source: Calculated by the author

The statistical validities of the models were investigated using a series of diagnostic tests to ensure that the errors are serially uncorrelated and normally distributed. This is important because it provides confidence that the empirical findings accurately reflect the proposed constructs. Table 5.2 provides SVAR miss specification tests for EAC members; it reports the Jarque-Bera statistics and Q-statistics for serial correlation and normality test, respectively; values in parentheses are the p values. The Jarque-Bera test is a popular test that incorporates both skewness and kurtosis to produce an overall test for normality (Diebold, 2004). The null hypothesis of the Jarque-Bera is that the residuals are normally distributed. The results in the Table 5.2 shows that diagnostic tests are satisfactory (with the exception of Rwanda), since the computed statistics of the Jarque-Bera test in the above table are not significant as the p values in the parentheses are larger than the 95 % critical values.

The table also provides the Ljung-Box Q-statistic which is used to test whether residuals are serially correlated or not; the null hypothesis for the Ljung-Box Q-statistic is based on that the data series are white noise (meaning no autocorrelation up to lag order *k*). It is noted that, if there is no serial correlation in the residuals, all Q-statistics should be insignificant with large p-values (Quantitative Micro Software, 2004). As we see from the above Table 5.2 we don't reject the null hypothesis, therefore, the diagnostic tests for the serial correlations of SVAR are satisfactory, as the p values in the parenthesis are bigger than 0.05; hence, we allow for the possibility the residuals are serially uncorrelated and normally distributed, in other words the estimators have good properties of consistency and asymptotic normality (stationary and erotic processes).

After testing normality, stationary and miss-specification test, we proceed to do further test which is VAR stability condition test. The estimated VAR model is considered stable (stationary) when all roots have modulus less than one and lie inside the unit circle (Agung, 2009). When the estimated VAR model is not stable, certain results (such as impulse response standard errors) are not valid (Quantitative Micro Software, 2004); therefore, it is necessary to test the Eigenvalue stability test of each country model to detect the stability condition or any other structural changes in the series (Agung, 2009). Table 5.3 presents VAR stability check of the EAC and EMU member countries models. As the table shows, VAR models of all the five EAC countries were found to fulfil the stability condition; as all their roots lie inside the unit circle, which indicates that the VAR model is stable. Therefore, our VAR modelling on the five EAC countries are good VAR model, therefore, we can proceed to further analysis (Manap, 2007).

Table 5-3: Eigen value stability condition

	EIGENVALUE	MODULUS
1	**BURUNDI**	
	0.989713 - 0.025425I	0.990040
	0.989713 + 0.025425I	0.990040
	0.759729	0.759729
2	**KENYA**	
	0.989848	0.989848
	0.683812 - 0.197721I	0.711823
	0.683812 + 0.197721I	0.711823
	0.361711 - 0.451165I	0.578260
	0.361711 + 0.451165I	0.578260
	0.120929	0.120929
3	**RWANDA**	
	0.992439	0.992439
	0.856143 - 0.094065i	0.861295
	0.856143 + 0.094065i	0.861295
4	**TANZANIA**	
	0.982272 - 0.046866i	0.983390
	0.982272 + 0.046866i	0.983390
	0.667721 - 0.338526i	0.748633
	0.667721 + 0.338526i	0.748633
	-0.076167	0.076167
	0.034436	0.034436
5	**UGANDA**	
	0.995822 - 0.016134i	0.995953
	0.995822 + 0.016134i	0.995953
	0.804606	0.804606

No root lies outside the unit circle.
VAR satisfies the stability condition

Another critical issue in VAR models is that the estimated results derived from SVAR models are sensitive to lag length selection so to solve this problem it is necessary to use model selection technique of Schwarz Information Criteria (Manap, 2007); Schwarz Information Criteria can be used for model selection such as determining the lag length of the VAR. Table 5.4 display the optimal lag length of the different VAR models. According to the Table 5-4, almost all EAC member countries with the exception of Kenya and Tanzania have lag order 1; the Kenyan and Tanzanian VAR models have lag order of 2.

Table 5-4: VAR lag order selection criteria

Country	Lag	Criteria
Burundi	1	SIC
Kenya	2	SIC
Rwanda	1	SIC
Tanzania	2	SIC
Uganda	1	SIC

5.2 Symmetry of Disturbances

This section empirically evaluated the prospects of a currency union in East African Countries based on a multivariate structural VAR model. The study used the Bayoumi and Eichengreen (1993, 1994, and 1999) technique[5] to analyze the symmetry and asymmetry of shocks affecting East African countries. The OCA literature had stressed the importance of symmetric shocks for monetary union. Countries facing with highly correlated shocks tend to have higher tendency to form or join a currency union (Michael J Artis, 2003; Harake, 2010). The section would cover the following topics: correlation of supply and demand shocks, impulse response analysis, variance decomposition analysis, and lastly ANOVA & coefficient of variance analysis.

[5] Bayoumi and Eichengreen used two-variable VAR model but this paper extends to four variables

5.2.1 Correlation of Disturbances

After extracting shocks[6] from the structural vector autoregressive (VAR) models, the study used cross country correlation analysis to examine the co-movements of economic disturbances in East African Countries. The Co-movements of economic shocks across countries are considered important condition towards the formation of currency union area (Kandil & Trabelsi, 2009). Table 5.5 through 5.10 reports the correlation coefficients of the identified supply and demand shocks among the East African countries. The correlation coefficient of the shocks can inform us whether currency union is possible or not; the idea is that the more symmetric the shocks as indicated by positive correlations, the more feasible it becomes for a group of countries to establish a monetary union (Kandil & Trabelsi, 2009).

Table 5-5: Correlations of supply shocks (GDP), 1980 to 2010

	Kenya	Rwanda	Uganda	Burundi	Tanzania
Kenya	1.000000				
Rwanda	-0.049589	1.000000			
Uganda	0.175357	-0.286582	1.000000		
Burundi	0.020002	0.376136	-0.388738	1.000000	
Tanzania	0.219422	0.308115	0.097676	0.017901	1.000000

Table 5.5 presents the correlation coefficients of domestic supply shocks across EAC countries, for the period 1980-2010. In general, most of correlation coefficients of EAC domestic supply shocks show were positive, albeit low; the highest three correlation coefficients found were Burundi-Rwanda (0.38), Rwanda-Tanzania (0.31) and Kenya-Tanzania (0.22). The rest supply shock pairs had small correlation coefficients and with some negative correlations (Kenya-Rwanda, Burundi-Uganda and Rwanda Uganda). Positive correlation coefficients denote symmetric shocks while negative correlations

[6] External global supply shock, domestic supply shock, domestic demand shock and domestic monetary shock

indicate asymmetric shocks. The intuition is that the more symmetric the shocks, the more possible it becomes for a group of countries to establish a currency union (Alturki, 2007). In summary, according to the full sample period of 1980-2010, EAC countries didn't exhibit strong evidence of convergence of domestic supply shock, which will decide the feasibility of a currency union among partners of EAC.

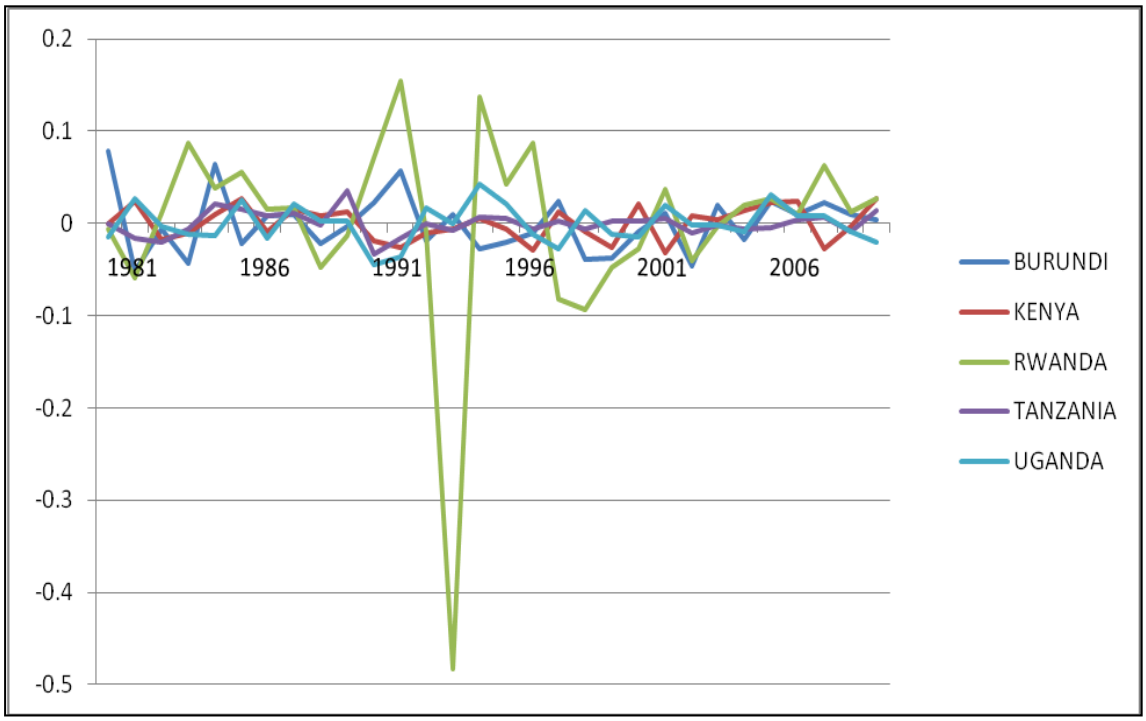


Figure 5-1: Evolution of domestic supply shock in EAC countries

Figure 5.1 above displays the evolution of domestic supply shock in EAC over time and tends to confirm the outcome of Table 5.6. The graph shows more volatile domestic supply shock for each of Rwanda, Burundi and Uganda, in contrast to a relatively more stable output growth for Tanzania and Kenya. Also, the graph shows that Rwanda had big negative supply shock in 1994, this is due to that Rwanda was in civil war in that period. Although the domestic supply shock in the EAC countries tend to be volatile but they show some degree of symmetry and convergence over the past decade (2001-2010), the reason behind this would discuss on the following paragraphs.

Table 5-6: Correlations of demand shocks (price), 1980 to 2010

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1.000000				
Kenya	0.415226	1.000000			
Rwanda	0.473356	0.147532	1.000000		
Tanzania	0.094905	-0.077420	0.033194	1.000000	
Uganda	-0.110179	-0.010429	0.144217	-0.032532	1.000000

Table 5.6 provides correlation coefficients of demand shocks across EAC countries for the years of 1980-2010. Demand shocks are somewhat stronger in EAC region than does the supply shock, but there are still some correlations with negative signs. Burundi and Rwanda show strong demand shock with the other members of the region. This evidence reflects some degree of symmetry adjustments to demand shocks in these two countries. In contrast, the correlations of Kenya and Uganda in demand shocks were negatively correlated with the other countries reflecting asymmetry of demand disturbances in these two countries. Such evidence discounts the potential of Kenya and Uganda for integration in EAC currency union.

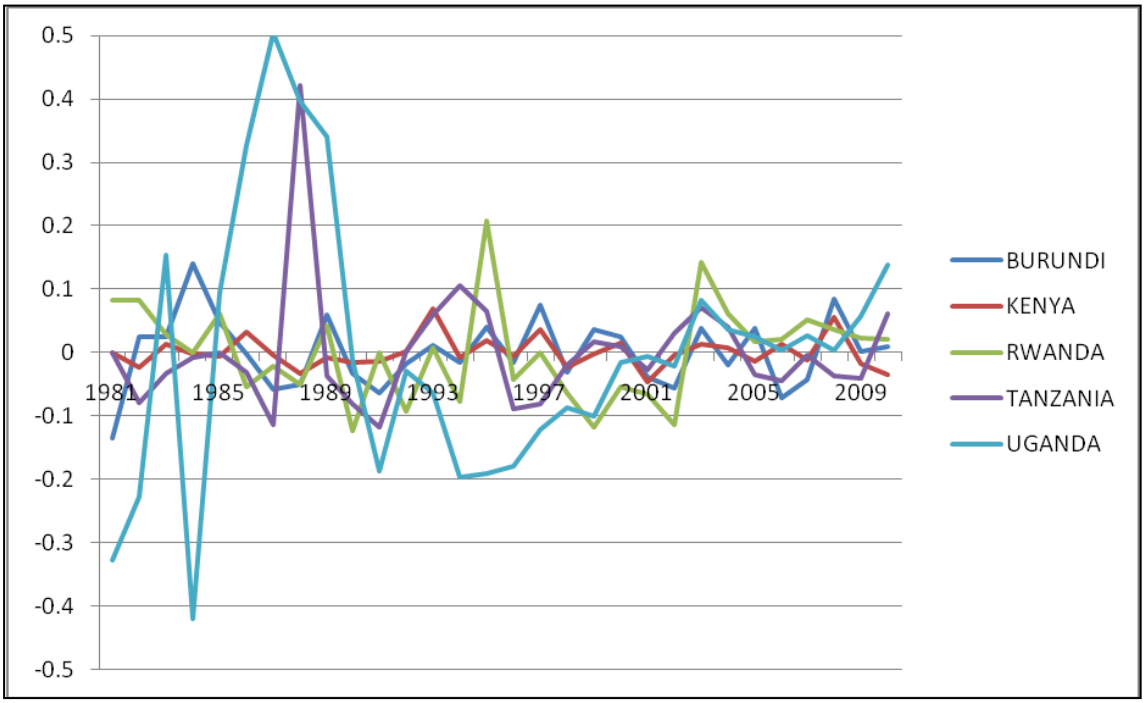


Figure 5-2: Evolution of domestic demand shock in EAC countries

Figure 5.2 shows the domestic demand shock of East African Community; domestic demand shock was derived from the price deflator to accounts for inflation. As we see from the graph, Uganda suffered major downturns of domestic demand shock in early 1980s; this shock was explained that Uganda was suffering with civil strife in that time (Mburu, 2006). Contrarily, Tanzania had big positive demand shock in the years of 1987 to 1989; this shock may be the of the implementation of a three year economic recovery program in that period by the Tanzanian government (Wagao, 1990). In the recent year of the graph, it seems that EAC countries are having symmetric price shocks. In summary, with the exception of Tanzania and Uganda, EAC countries have relatively better demand shock compared to the earlier supply shock discussed in above.

Table 5-7: Correlations of monetary shocks (RER), 1980 to 2010

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1.000000				
Kenya	-0.249515	1.000000			
Rwanda	-0.004835	0.342709	1.000000		
Tanzania	-0.335679	0.084516	-0.277281	1.000000	
Uganda	-0.031232	-0.046885	-0.241585	-0.234341	1.000000

The results in table 5.7 display EAC monetary shocks for the full period of 1980-2010, the full sample period. The table display negative correlations between monetary shocks across EAC countries; ruling out the potential of symmetric adjustments in the context of a currency union. According to the table, Burundi and Uganda had different monetary shocks than the other EAC countries' monetary shocks. Thus, EAC monetary shocks display asymmetric pattern, as indicated by the small negatively correlated coefficients. On the other hand, Table 5.8 display the correlations of external shocks which are positive across EAC countries during the period 1980-2010 (full sample). This means EAC countries are highly open to the rest of the world. The positive and significant correlations of external shocks across countries attest to mutual benefits for symmetric adjustments in the context of currency union (Kandil & Trabelsi, 2009). Therefore, East African economies respond to global shocks in a symmetric way.

Table 5-8: Correlations of global supply shocks 1980 to 2010

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1.000000				
Kenya	0.863983	1.000000			
Rwanda	0.909345	0.843864	1.000000		
Tanzania	0.632002	0.586489	0.721949	1.000000	
Uganda	0.796384	0.811680	0.789736	0.612748	1.000000

Post EAC formation

The East African Community was established in 2000, and since then they had made some progress toward policy harmonization[7], thus, it is necessary to test whether EAC countries had made progress in similarity of macroeconomic shocks after its formation (K.A. Sheikh, et al., 2011). Given the above argument it would be informative if the cross correlation coefficients are calculated for the period after the formation of the union. Thus, to investigate whether the degree of similarity of shocks has increased after the EAC establishment in 2000, we consider data from the years 2001-2010 (table-3).

Table 5-9: EAC correlations of supply shocks (GDP), 2001 to 2010

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1.000000				
Kenya	0.118996	1.000000			
Rwanda	0.665029	-0.392759	1.000000		
Tanzania	0.743174	-0.320554	0.728339	1.000000	
Uganda	0.313771	-0.146557	0.114633	0.097214	1.000000

As we see from Table 5.9, correlation coefficient of EAC domestic supply shock had improved since it has higher correlation coefficient than the full data set –1980-2010. As Table 5.10 shows correlation coefficient of domestic supply shock in this sub sample ranges from 0.10% (Tanania-Uganda) to 0.73% (Rwanda-Tanzania). But for this sample period of 2001-2010, Kenyan had a negative domestic supply shock correlation with the rest of the countries in the sample, signifying major structural differences. Thus, the costs of Kenyan participation in EAC monetary union would be higher than the benefits of joining EAC currency union.

[7] After the formation EAC in the year 2000, it had established free trade area, customs union, common market and currently towards a Monetary Union.

Table 5-10: Correlations of demand shocks (price), 2001 to 2010

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1.000000				
Kenya	0.699683	1.000000			
Rwanda	0.544576	0.702392	1.000000		
Tanzania	0.437628	0.557765	0.373354	1.000000	
Uganda	0.411995	0.463028	0.772873	0.728389	1.000000

To take a closer look at the results of sample period of post EAC formation[8] (2001 to 2010, the sub-sample), we analysed data from this period 2001-2010. Comparing the coefficients of the correlations of domestic demand shocks in Table 5.7 (full sample period of EAC demand shock correlations) to those in Table 5.10 (post EAC formation correlations of demand shocks) indicates that EAC countries had experienced symmetric demand shocks in the last 10 years more than they did in the 1980s and 1990s period. All of the correlations of demand shocks have increased in the last 10 years. The correlation coefficient of the domestic demand shocks for this sub sample ranges from 0.37% (Rwanda-Tanzania) to 0.77% (Rwanda-Uganda). To sum up, the findings of demand shocks suggest that EAC countries tend to be affected by similar domestic shocks.

Table 5-11: Correlations of monetary shocks (RER), 2001 to 2010

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1.000000				
Kenya	-0.545313	1.000000			
Rwanda	-0.713229	0.658056	1.000000		
Tanzania	-0.109426	0.328387	0.135101	1.000000	
Uganda	-0.449335	0.771141	0.392428	-0.255345	1.000000

[8] The East African Community was established in 2000, and since then they had made some progress toward policy harmonization, thus, we need to test whether they had made improvement in symmetry of macroeconomic shocks after that period.

The results in Table 5.11 and Table 5.12 display the correlations of monetary and external supply shocks among East African countries for the period of post EAC formation – 2001-2010 (sub-sample). Both the tables show that during the period of post EAC formation the correlation coefficients of monetary and external supply shocks had improved; for the Burundian monetary shocks still shows negative correlation with the rest of other EAC member states, this can be interpreted as Burundian monetary shocks are dissimilar with the rest of the region. The rest of the correlation coefficients of EAC monetary shocks show positive pair relationships, with the exception of Uganda-Tanzania. On the other hand, Table 5.12 shows correlation coefficient of the global supply shocks in this sub sample (2001-2010) ranges from 0.65% (Uganda-Tanzania) to 0.97% (Burundi-Uganda), this correlation coefficient is high. The table shows that the effect of global supply shock in the region is strong and affects symmetrically.

Table 5-12: Correlations of global supply shocks 2001 to 2010

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1.000000				
Kenya	0.965727	1.000000			
Rwanda	0.987259	0.952287	1.000000		
Tanzania	0.722408	0.759537	0.806469	1.000000	
Uganda	0.968019	0.883038	0.956302	0.649912	1.000000

According to the above results, in the period after the formation of EAC we observed that the symmetry of macroeconomic shocks of East African countries had improved remarkably; Kishor and Ssozi (2009) as well as Mafusire and Brixiova (2012) have found similar results to this, as they have found that the degree of symmetry of EAC members have improved after the formation of EAC treaty. For sure, this is due to the deepening and widening of East African Community which had implemented a set sequence policies towards economic integration; as during this period (2001-2010) EAC had achieved preferential trade area, free trade area status; had established a customs union in 2005; implemented common market protocol in 2010; and currently towards the formation of Monetary Union by the end of 2012.

Overall, the study had found some degree of symmetry shocks between EAC countries but this evidence alone is not enough to support the formation of monetary union in the region. We need to compare our results with the results of other existing monetary unions such as EMU, GCC, WAMZ, COMESA, SADC etc. According to Alturki (2007) and Pentecote (2012), EMU and GCC countries have high levels of economic integration and macro-economic convergence compared to the EAC countries; thus, EMU and GCC were more ready to form monetary union than the EAC. On the other hand, EAC countries have relatively better correlated shock compared to CEMAC, COMESA, SADC and WAMZ (S. K. Buigut & Valev, 2005a; Jefferis, 2007; Njoroge et al., 2011; Omotor & Niringiye, 2011).

5.2.2 Size and Homogeneity of Shocks

In addition to isolating the underlying disturbances, the symmetry and asymmetry of shocks affecting East African countries can measured by using one-way Anova[9] analysis and coefficient of variance analysis (CV). The one-way Anova analysis would test the equality of means and variance of these shocks across EAC countries. The idea is that, if the ANOVA results show that there is no significant difference in means of supply and demand shocks of EAC, and then EAC countries are having similar shocks, thus they can form monetary union.

Second to the Anova analysis, we also measured the extent of volatility of supply and demand shocks using the coefficient of variation (CV); a measure for the size of shocks. The smaller the size of a given shock, the better candidate the economy is for a monetary union because smaller shocks implies less reliance on stabilization policies such as nominal exchange rate adjustments. Usually, a CV of less than 1 is conventionally taken as reflecting data with an acceptable degree of variation, whereas a CV value of more than 1 represents a significant level of heterogeneity and it is an evidence of increasing degrees of variability among cases (Fischer, 2000; Palmer & Reid, 2001).

Table 5-13: One-way ANOVA test and coefficient of variance

Countries	Levente-Sig. (P-value)	ANOVA-Sig. (P-value)	Coefficient of Variance
Supply Shock	0.5746	0.6871	8.155041
Demand Shock	0.1412	0.5456	9.541567
Monetary Shock	0.0000	0.9888	55.59421
Global Shock	0.0983	0.5901	602.5789

[9] Analysis of Variance is a parametric procedure used to determine the statistical significance of the difference between the means of two or more groups of values.

Table 5.13 provide the summary results of both the one-way Anova test and coefficient of variance test. As shown by the Levente test in Table 5.13, the external supply shock, domestic supply shock and domestic demand shocks of EAC countries were identical, only the monetary shock is not stationary. Thus, we can proceed to next step of the analysis of variance analysis. In the Anova column, it shows that external supply shock, domestic supply shock and domestic demand shocks of the EAC countries do not differ in this given sample period; thus we can say EAC countries had identical macroeconomic shocks for the period of 2005 to 2010. For the coefficient of variance values; it shows that all the sizes of internal and external shock of the EAC are dissimilar, as their CV values are greater than 1; domestic supply and demand shock have relatively smaller CV compared to the monetary and global supply shocks. In summary, CV of macroeconomic shocks in EAC member countries have shown higher degree of variation, thus, monetary formation of monetary union is costly.

Table 5.14 reports the magnitudes of domestic supply shock, domestic demand shock, domestic monetary shock and lastly external global supply shock. The larger the size of the underlying shock, the more difficult to maintain fixed exchange rate and the less chances to form monetary union. The size of shock is measured as the standard deviations (per annum) of the shocks observed in each country (T. Bayoumi & Eichengreen, 1992). The table gives several conclusions; 1st demand and monetary shocks appear to be larger than the domestic and external supply shocks; 2nd the size of the shocks appear to be small, with the exception of Tanzanian monetary shock. These sizes of shocks resemble to those found in previous studies based on European Monetary Union as well as the proposed monetary union of Gulf Co-operation Council (Alturki, 2007; T. Bayoumi & Eichengreen, 1992).

Table 5-14: Size of internal and external shock in EAC

Countries	Supply Shock	Demand Shock	Monetary Shock	Global Supply Shock
Burundi	0.0248	0.0620	0.0917	0.0356
Kenya	0.0187	0.0247	0.0671	0.0491
Rwanda	0.0304	0.0709	0.0599	0.0331
Tanzania	0.0060	0.0487	45.0703	0.0382
Uganda	0.0146	0.0661	0.0299	0.0463

Note: all variables are measured in log forms, thus, standard deviations of shocks are in percentage.

5.2.3 Impulse Response Function Test

Having analyzed the results of the correlation analysis of supply and demand shocks, we proceed to look at the impulse response function (IRF) to evaluate the speed of adjustment to shocks. The IRF traces the dynamic effect of 1 standard deviation (SD) to respective structural shock on variables of VAR model over a period of 20 years horizon (Kandil & Trabelsi, 2009). The implication of this analysis is that if the magnitude and type of responses of the variables to the structural shocks are similar across countries, then a common currency and monetary policy can be effective to address each country's economic needs. If, on the other hand, countries have different patterns of responses to shocks, the likelihood of a successful monetary union is reduced (Alturki, 2007).

Table 5.16 summarizes the dynamic responses of various shocks to the domestic output, exchange rate and the prices. To conserve space, Table 5.16 provides the results of the impulses of the 1st, 5th and 10th horizon; details of the other IRF forecast horizons are available in appendices. The table shows that in general, the impulse responses of domestic supply in EAC countries were small, all being less than 5 percent, but greater than those for the Euro-block and the GCC (Alturki, 2007). The speed of adjustment is relatively high as the shocks are dissipating within the following ten years. The table also indicate that domestic and external supply shocks impact more on domestic output while domestic demand and monetary shocks have less impact on domestic output.

On the other hand, the impulse responses of real exchange rate in EAC countries to monetary shock were small, all being less than 15 percent, but greater than those of domestic supply. The speed of adjustment is relatively high, with most effects dissipating with the following ten years (with the exception of Tanzania and Uganda). Monetary shocks have more impact on the real exchange rate while both the supply and demand shocks have less effect on the real exchange rate. Finally, the impulse responses of the price level (domestic demand) in EAC countries to monetary shocks were small, all being less than 15 percent, but greater than those of domestic supply. The speed of adjustment is relatively high, with most effects dissipating with the following ten years (with the exception of Tanzania). Demand shocks have more impact on the real exchange rate while both the supply and monetary shocks have less effect on the price level. In summary, the impulse response had indicated that majority (but not all of them) of EAC member countries had similar magnitudes of shocks and speed of adjustment, tentatively suggesting the possibility of monetary union for at least some EAC member countries; Buigut (2006) had found similar results of impulse response in EAC region.

Table 5-15: EAC size of impulse responses

Countries	Period	Domestic real output				Real exchange rate				Price level			
		World Supply Shock	Supply Shock	Monetary Shock	Demand Shock	World Supply Shock	Supply Shock	Monetary Shock	Demand Shock	World Supply Shock	Supply Shock	Monetary Shock	Demand Shock
Burundi	1st	0.000047	0.036910	-0.00625	-0.01594	-0.02716	-0.01616	0.09551	-0.00492	-0.00302	-0.02670	-0.00319	0.06184
	prd	0.002936	0.033897	-0.01709	-0.01135	-0.02081	0.00649	0.04889	-0.00208	0.03716	-0.04344	-0.00161	0.04802
	5th	0.006944	0.026194	-0.02129	-0.00748	-0.00353	0.01191	0.00923	0.00167	0.03142	-0.02378	0.03844	0.02236
	10th												
Kenya	1st	0.014037	0.019865	-0.00779	-0.00728	-0.04273	-0.03727	0.095058	0.014744	-0.002754	-0.01096	0.00464	0.02993
	prd	0.019743	0.019096	0.001929	-0.00602	-0.04279	-0.03937	0.041194	0.016456	0.018409	0.01304	-0.01562	0.01404
	5th	0.014908	0.015148	0.012576	-0.00588	-0.03246	-0.03214	-0.00269	0.015266	0.036252	0.031909	-0.01092	0.00044
	10th												
Rwanda	1st	0.005623	0.042865	-0.00769	-0.01506	-0.01483	-0.01519	0.084707	-0.00078	-0.01444	-0.02344	-0.00061	0.06672
	prd	-0.02042	0.014308	0.006513	0.022044	0.02937	-0.02924	0.079118	-0.03459	0.033889	-0.01491	0.03444	0.01274
	5th	-0.00439	-0.00825	0.026705	0.019016	0.06243	-0.01279	0.054962	-0.08001	0.075772	-0.00385	0.066629	-0.04674
	10th												
Tanzania	1st	0.005676	0.013401	-0.00164	-0.00185	0.02868	-0.01385	0.113237	-0.01538	0.00689	-0.01349	-0.01326	0.097654
	prd	0.005077	0.029518	-0.01195	0.002946	0.056677	0.06489	0.040996	0.017372	0.11926	0.077287	0.071458	0.053069
	5th	-0.002008	0.019327	-0.03886	0.008517	-0.02567	-0.02379	-0.08969	0.025272	0.03742	0.041033	-0.07875	0.067432
	10th												
Uganda	1st	0.012441	0.026419	-0.00787	0.003802	-0.05109	-0.04462	0.149711	-0.051642	0.011543	0.022733	-0.05448	0.157951
	prd	0.058933	0.034863	-0.02245	0.010306	0.01057	0.01840	-0.05373	0.011706	0.151022	-0.04095	-0.06430	0.151693
	5th	0.021476	0.014122	-0.00377	0.016068	0.01355	-0.01225	0.011825	0.030581	-0.148382	-0.08858	0.017401	0.04265
	10th												

5.2.4 Variance Decomposition Test

Next to the impulse response analysis, variance decomposition analysis was carried out in order to show the contribution of each shock to movements in the 4 variables of the SVAR model. This gives the proportion of the movements in the dependent variables that are due to their 'own' shocks, versus shocks to the other variables (Salim, Rafiq, & Hassan, 2008). Table 5.16 reports the variance decomposition for all the EAC countries in the short-run, one-year forecast error, and in the long-run, ten year and twenty-year forecast error. Details of the variance decomposition over other forecast horizons are provided in the appendices. In terms of variance decomposition of domestic real output external supply shocks

Table 6.16 shows that domestic supply shocks are the predominant shocks in the variability of domestic real output levels in all countries. The Kenya had shown the lowest domestic supply shock in the region at about 50 percent. Burundi and Rwanda, on the other hand, scored the highest proportion of domestic supply shock of about 98 percent over a one-year horizon. Also, external supply shocks have a substantial part in explaining the variability of domestic real output; such a dominant share (shock to world GDP) reflect the dominant share of international trade in determining domestic output supply of the region. The domestic demand shocks as well as monetary shocks explain a small proportion of the movement in domestic output.

The variability of price inflation across EAC is highly dependent on the domestic demand shocks which account for more than 78 percent in the case of Burundi and 91 percent in the case of Tanzania, for a one-year horizon. On the other hand, supply shocks represent a substantial proportion of variances in price levels of Burundi, Kenya and Rwanda for a one-year horizon; while monetary shock represents a quite proportion of variances in price levels Tanzania and Uganda. In terms of variance decomposition of real exchange rate, monetary shock and external supply shocks dominated the demand shocks and they explained a large part of the variability of real exchange rate in all countries. Domestic supply shock represented a substantial proportion of variances in real exchange rates of Burundi and Rwanda with an effect of more than 89 and 94 percent respectively. World supply shock represented a substantial proportion of variances in real exchange rates of Kenya and Rwanda with an effect of more than 20 and 11 percent respectively. Demand shocks have no effect on the real exchange rate.

The results of these variance decomposition analyses coincide with the results obtained by Buigut, (2006) and Mburu, (2006) for East African Community and Kandil and Trabelsi (2009) for the GCC monetary union. In summary, the variance decomposition results are in line with the impulse response results discussed in the section 5.2.3. The impulse response and variance decomposition results provided very important information about the interaction among the variables beyond the sample period (future impact) (Salim, et al., 2008). Both the impulse response and the variance decomposition results did not show strong pattern of responses to shocks, therefore, the likelihood of a successful monetary union in EAC region is doubtful.

Table 5-16: EAC variance decomposition of the changes in domestic real output, real exchange rate and price level

		Domestic real output				Real exchange rate				Price level			
		World Supply Shock	Supply Shock	Monetary Shock	Demand Shock	World Supply Shock	Supply Shock	Monetary Shock	Demand Shock	World Supply Shock	Supply Shock	Monetary Shock	Demand Shock
Burundi	1st												
	prd	0.00 /	100.00/	0.00 /	0.00/	8.09 /	2.85 /	89.06 /	0.00 /	0.24 /	18.64 /	2.15 /	78.97 /
	20th	3.84	79.85	16.01	0.30	12.00	6.40	78.49	3.11	16.32	22.24	39.48	21.96
Kenya	1st												
	prd	49.93 /	50.07 /	0.00 /	0.00 /	20.20 /	1.11 /	78.69 /	0.00 /	0.85 /	18.12 /	0.60 /	80.43 /
	20th	31.48	7.27	59.57	1.69	37.86	4.62	55.20	2.32	54.34	5.78	30.60	9.28
Rwanda	1st												
	prd	1.72 /	98.28 /	0.00 /	0.00 /	3.06 /	2.49 /	94.44 /	0.00 /	4.68 /	10.61 /	1.03 /	83.68 /
	20th	26.24	13.02	43.18	17.55	18.67	4.99	39.84	36.49	37.41	1.52	41.17	19.90
Tanzania	1st												
	prd	17.94 /	82.06 /	0.00 /	0.00 /	6.41 /	6.43 /	87.16 /	0.00 /	0.49 /	3.44 /	4.63 /	91.43 /
	20th	5.59	55.52	32.92	5.97	13.17	9.48	73.23	4.12	41.61	5.97	24.35	28.07
Uganda	1st												
	prd	22.17 /	77.83 /	0.00 /	0.00 /	11.65 /	2.42 /	85.93 /	0.00 /	0.53 /	1.54 /	10.52 /	87.40 /
	20th	79.27	9.19	0.78	10.75	51.54	7.92	31.53	9.00	42.62	15.38	9.45	32.54

The different values show the percentage change of the forecast error variance in the world real output, domestic output, real exchange rate and price level resulting from each shock over an horizon of 20 years.

5.3 Business Cycle Synchronization Approach

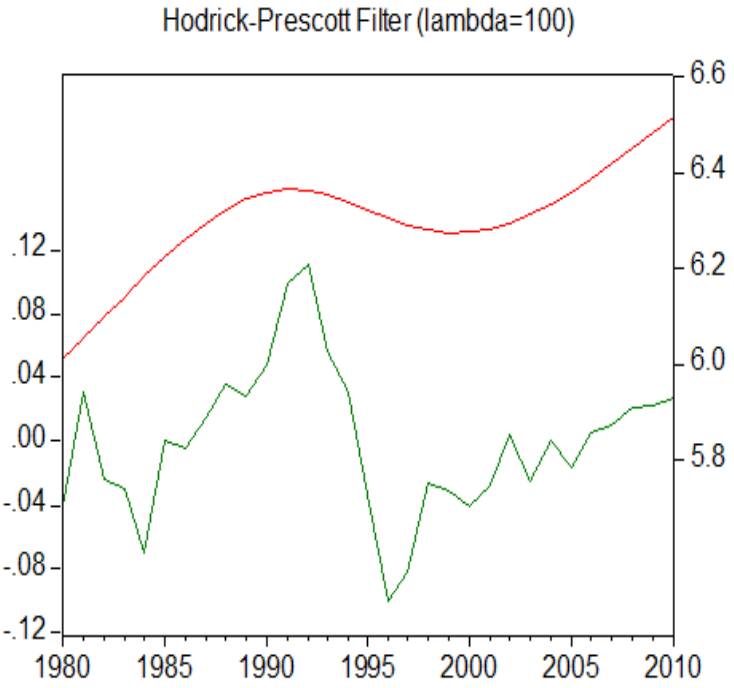
This section aims to assess the feasibility of the proposed East African Monetary Union by examining the synchronization of business cycles within EAC countries. According to the OCA theory literature, synchronization of business cycles is a key requirement for the formation of a monetary union and it combines many properties of OCA theory (Mburu, 2006). This method of analysis is an alternative way (to SVAR method) of analyzing feasibility of monetary union in EAC; it is used to identify whether future members of a monetary union face correlated trend and cyclical components of their macroeconomic indicators like GDP, unemployment, inflation, consumption etc (K.A. Sheikh, et al., 2011). Increased intra-regional trade in currency area would increase the synchronization of the business cycles and shocks (Alturki, 2007).

There are a huge number of empirical studies on this type of analysis and most of them are emphasized on the EMU, East Asia and GCC rather than East African Community. See chapter 4 for more about empirical literature of this method. The section would cover the following topics: graphical analysis of the dynamics of the permanent and transitory components of business cycles using HP filler, correlation analysis of permanent and transitory components using HP filler, graphical analysis of the dynamics of the permanent and transitory components of business cycles using BP filter, correlation analysis of permanent and transitory components using BP filter, and lastly ANOVA analysis of the business cycles.

5.3.1 Graphical Analysis of the Dynamics of the Permanent and Transitory Components of the Business Cycles using HP Filter

The study examined the cross country correlations of the permanent and cyclical components of GDP and it gives a conclusion of whether EAC countries are characterized by synchronized business cycles or not. It starts with graphical analysis of the business cycle turning point then it would present correlation analysis of the permanent and cyclical component of the growth rate. Figure 5.3 through 5.7 gives the cyclical components of the growth rates for the five EAC countries along with a table summarizing the turning points of business cycles. The visual analysis of these graphs draws an interesting picture of growth path and business cycle similarity among the EAC countries.

Figure 5.3 shows the permanent and temporary components of the Burundi GDP growth rate. The growth path of the Burundi GDP shows a strong positive trend from 1980 to the early 1990s. As shown by both the permanent and transitory components, a large negative shock hit the Burundian economy in the mid 1990s during the civil unrest which resulted major economic downturn (Njoroge, et al., 2011). As explained by the positive cycle in the 1996 the economy had recovered from this shock. Also, the graph shows that in the last decade cycle volatility of the Burundi cycle had reduced as we would see for the other EAC countries. This can indicate some degree of similarity of temporary shocks in the last decade.

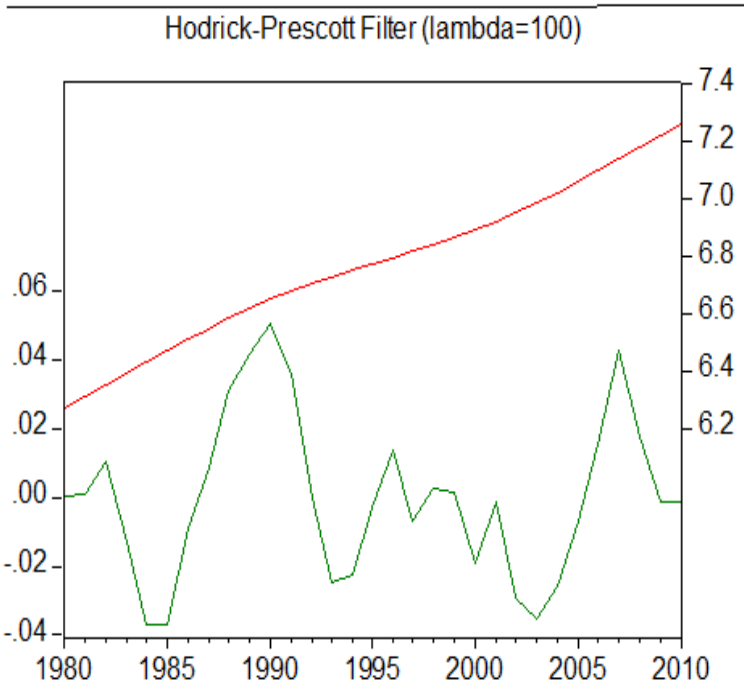


Burundi

HP starts	HP Ends	Duration
1980	1981	1(+)
1982	1984	3(—)
1985	1992	7(+)
1993	1996	3(—)
1997	1998	1(+)
1998	1999	1(—)
2000	2002	2(+)
2003	2004	2(—)
2005	2010	5(+)

Figure 5-3: Hodrick-Prescott decomposition of Burundi GDP (1980-2010)

Similar to the preceding figure, the growth path (permanent component) of the Kenyan GDP shows a strong positive trend through 1980 to 2010 as can be seen in Figure 6.4. As shown by the deep trough of the cycle (transitory components) in the 1990s Kenya had suffered a strong negative shock on their economy, similar case to other EAC countries. Contrary to the other EAC countries; the graph shows that Kenya had suffered two more negative economic shocks in the 2003 and 2009, in which both these years the country had big violent presidential elections. But, the good thing is that, the graph shows a recovery trend in the year 2010, this may indicate that Kenya is recovering from the economic downturn of the election chaos.

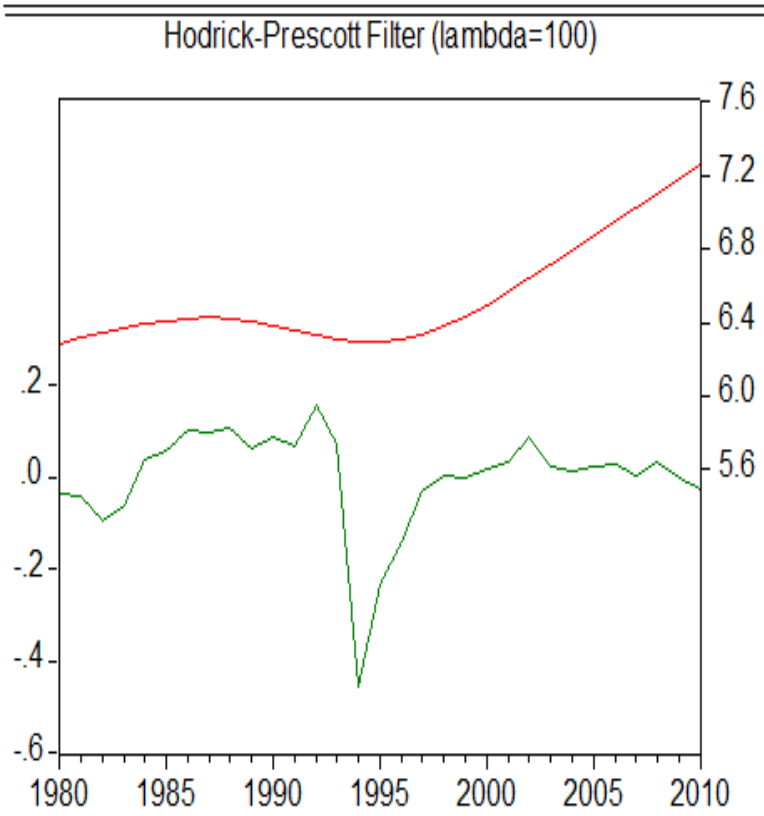


Kenya

HP starts	HP Ends	Duration
1982	1985	3(—)
1986	1990	4(+)
1991	1994	4(—)
1994	1996	3(+)
1996	1997	1(—)
1999	2000	1(—)
2000	2001	1(+)
2001	2003	2(—)
2003	2007	4(+)
2008	2009	1(—)
2009	2010	1(+)

Figure 5-4: Hodrick-Prescott decomposition of Kenya GDP (1980-2010)

Figure 5.4 shows the permanent and temporary components of the Rwandan GDP growth rate. The Rwandan growth path exhibits a relatively smooth positive trend in the period from 1980 to 1994, and a mild negative growth path in the mid 1990 which is due to civil unrest in this period which inflicted major economic downturn; but it again showed a strong positive growth path in the last decade. The structural break of the GDP growth in 1994 is also shown in the negative temporary shock. Finally, similar to the Burundi case, the temporary component of GDP growth rate shows very low variability in the last decade.

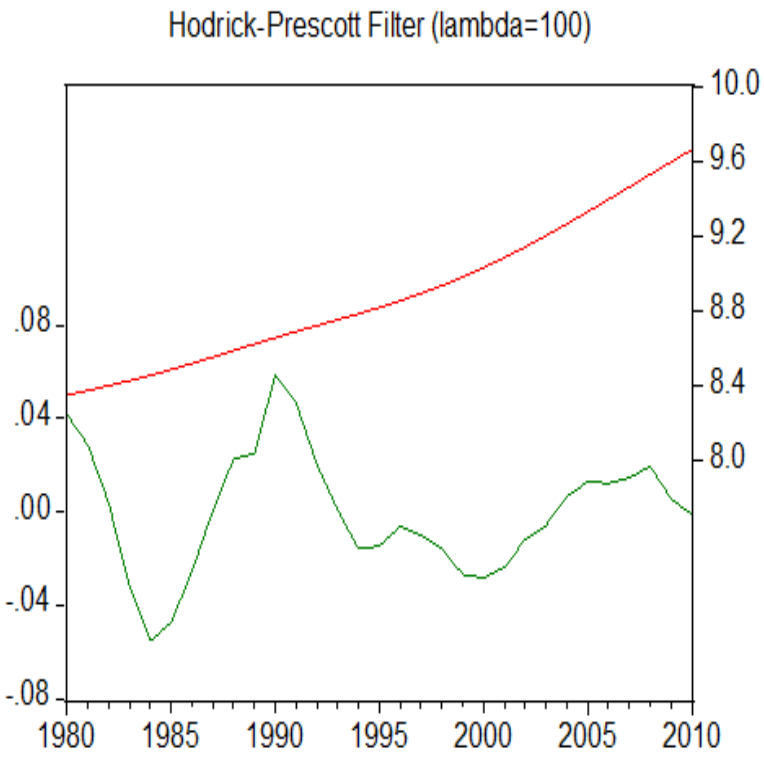


Rwanda

HP starts	HP Ends	Duration
1980	1982	2(−)
1983	1988	5(+)
1988	1989	1(−)
1990	1992	3(+)
1993	1994	2(−)
1995	2002	7(+)
2002	2003	1(−)
2004	2010	0(+)

Figure 5-5: Hodrick-Prescott decomposition of Rwanda GDP (1980-2010)

Figure 5.6 show that Tanzanian growth path exhibits strong positive trend as some other EAC countries did, from 1980 to 2010. For the cyclical component it shows negative temporal shocks in the early 1980s and 1990s, as did by some other EAC countries. The graph also shows a positive temporal shock from mid 1980s until 1989; this shock may be the implementation of a three year economic recovery program in that period by the Tanzanian government (Wagao, 1990). On the other hand, the temporal component of GDP growth rate of the Tanzanian economy had shown relatively low variability in the last decade; this is similar to the other EAC countries.

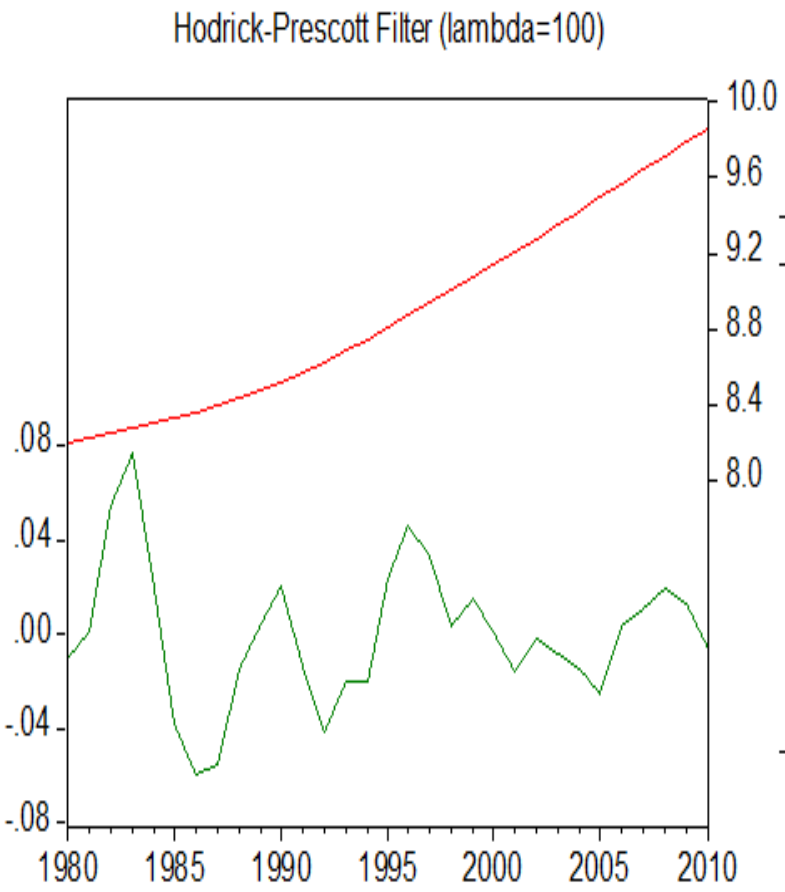


Tanzania

HP starts	HP Ends	Duration
1980	1984	4(−)
1984	1990	7(+)
1991	1994	4(−)
1994	1996	3(+)
1996	2000	5(−)
1999	2000	1(−)
2001	2008	7(+)
2009	2010	2(−)

Figure 5-6: Hodrick-Prescott decomposition of Tanzania GDP (1980-2010)

Figure 5.7 shows the dynamics of the permanent and transitory components of the business cycles of the Ugandan growth path. Similar to the other EAC countries, the figure shows a strong positive trend (permanent component) from 1980 to 2010. Uganda had two negative temporal shocks in the mid 1980s and 1990s, as did by the other EAC countries. The first shock in early 1980s was due to the Uganda civil unrest after the collapse of the Edi Amin regime (Mkenda, 2001); while the later shock in early 1990s was something common in the EAC region.



Uganda

HP starts	HP Ends	Duration
1980	1983	3(+)
1983	1986	3(−)
1986	1990	4(+)
1990	1992	2(−)
1992	1996	4(+)
1999	2001	2(−)
2001	2003	1(+)
2003	2005	2(−)
2005	2008	3(+)
2009	2010	1(−)

Figure 5-7: Hodrick-Prescott decomposition of Uganda GDP (1980-2010)

In summary, the visual analysis of the GDP growth path of EAC countries demonstrate strong positive trend in the 1980 to 2010 in Kenya, Tanzania and Uganda. But Burundi and Rwanda experienced a mild positive growth rate in mid 1990s. For the temporal shocks, all EAC countries, except Kenya, had two main temporal shocks which are mid 1980s and mid 1990s. Kenya had two more temporal shocks which are in 2003 and 2009 in which it had massive chaos presidential election. Thus, the temporal components of GDP growth rate of EAC countries had shown relatively low variability in the last decade. Thus, the above visual analyses cautiously indicate that EAC business cycles are synchronization in the last decade, thus it seems that monetary union in EAC countries is feasible.

5.3.2 Correlation Analysis of Permanent and Transitory Components HP Filter

To further examine the pattern of business cycle synchronization among EAC countries we need to calculate correlation coefficient of growth rate permanent and temporal components of EAC countries, this is shown in Table 5.18 through 5.21. The idea is the higher the Synchronization of business cycles correlation coefficient, the greater the degree of synchronization. Thus, countries with highly correlated business cycles tend to have higher propensity to join in a monetary union; and vice-verse (K.A. Sheikh, et al., 2011).

Table 5-17: Correlation matrix of EAC countries permanent component (1980-2010)

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1.000000				
Kenya	0.834070	1.000000			
Rwanda	0.656778	0.817003	1.000000		
Tanzania	0.772366	0.985161	0.890077	1.000000	
Uganda	0.733642	0.982154	0.867935	0.997003	1.000000

Table 5.17 presents simple correlation matrix of EAC countries' permanent component. It shows very high correlation coefficients of the permanent components of EAC countries' growth rates. With only one exception, the correlation coefficients range from 73% (Burundi-Uganda) to 99% (Tanzania-Uganda). This evidence supports the conclusion that EAC countries experience similar patterns of growth over that period considered (1980 to 2010).

Table 5-18: Correlation matrix of EAC countries permanent component (2001-2010)

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1.000000				
Kenya	0.996013	1.000000			
Rwanda	0.992091	0.999330	1.000000		
Tanzania	0.994364	0.999853	0.999807	1.000000	
Uganda	0.993321	0.999639	0.999939	0.999951	1.000000

To investigate whether the degree of business cycle synchronization has increased after the EAC establishment in 2000, we consider data from the years 2001 to 2010 (Table 5.19). During this period, the correlation coefficient of the permanent component is higher than the full data set of 1980 to 2010. Thus, we can say, in the last decade (2001 to 2010), EAC countries had experienced similar pattern of growth rate. Similar results to this were found by Kishor, N.K., and Ssozi, J. (2011) who have found that synchronization has increased since 2000 when the EAC Treaty came into force.

Table 5-19: Correlation matrix of EAC countries cycles or irregular component (1980-2010)

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1.000000				
Kenya	0.325523	1.000000			
Rwanda	0.308366	0.164188	1.000000		
Tanzania	0.555251	0.711358	0.196737	1.000000	
Uganda	-0.461164	0.173362	-0.349380	-0.057127	1.000000

Table 5.20 shows the correlation coefficients of the cycle or irregular components of EAC countries' growth rates. The table shows more positive correlation coefficients of the EAC temporary components. Temporary components of Rwanda and Burundi are negatively correlated with Ugandan temporary component. The rest of the correlation coefficients show positive relationship among their temporary components (K.A. Sheikh, et al., 2011). To take a closer look at the results of sample period of post EAC formation (2001 to2010), we consider data from the years 2001 to 2010.

As we see from Table 5.21, correlation coefficient of EAC temporary (cycle) component had improved since it has higher correlation coefficient than the full data set. As Table 5.21 shows, correlation coefficient of the GDP temporary component in this sub sample ranges from 0.41% (Kenya-Burundi) to 0.70% (Uganda-Burundi). But for the sample period of 2001 to 2010, Rwandan temporary component of GDP got negative correlation with all other EAC countries; this can be interpreted as that Rwandan temporary shocks are dissimilar with the rest of the region. Thus, the costs of Rwandan participation in EAC monetary union would be higher than the benefits of joining EAC currency union.

Table 5-20: Correlation matrix of EAC countries cycles or irregular component (2001-2010)

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1.000000				
Kenya	0.416211	1.000000			
Rwanda	-0.349135	-0.342805	1.000000		
Tanzania	0.499987	0.534468	-0.307762	1.000000	
Uganda	0.708651	0.546768	-0.040462	0.440760	1.000000

5.3.3 Graphical Analysis of the Dynamics of the Permanent and Transitory Components of Business Cycles using BP Filter

On the other hand, we had also applied BP filter of the Baxter and King to enhance the analysis of EAC business cycles; and we compared them with the cycles identified by the HP filter. We found that both the two filters (HP and BP) show some similarities in the cycle and trend components of GDP. Figure 5.8 show the business cycle for Burundi, Kenya, Rwanda, Tanzania and Uganda, when the cycle for real GDP is identified using the BP filter.

The figure shows moderate synchronicity of the cycles and trends of the East African Community member countries. For instance, in the case of Burundi and Rwanda the HP and BP show identical trend in terms of length and timing, both show major economic downturn in the mid of 1990s owing to civil wars going on that time, but for the period of last decade EAC trend growth shows a mild positive trend (Opolot & Osoro, 2004). For the cycle component, the figure shows that all EAC countries have economic down turn in the mid of 1990s period as the Burundian and Rwandan civil war and genocide going on that time left the region's economy and social fabric in shambles (Opolot & Osoro, 2004). The years that followed have been characterized by reconstruction and ethnic reconciliation, thus, the region experience major cyclical peaks in the years after Burundi and Rwanda civil wars.

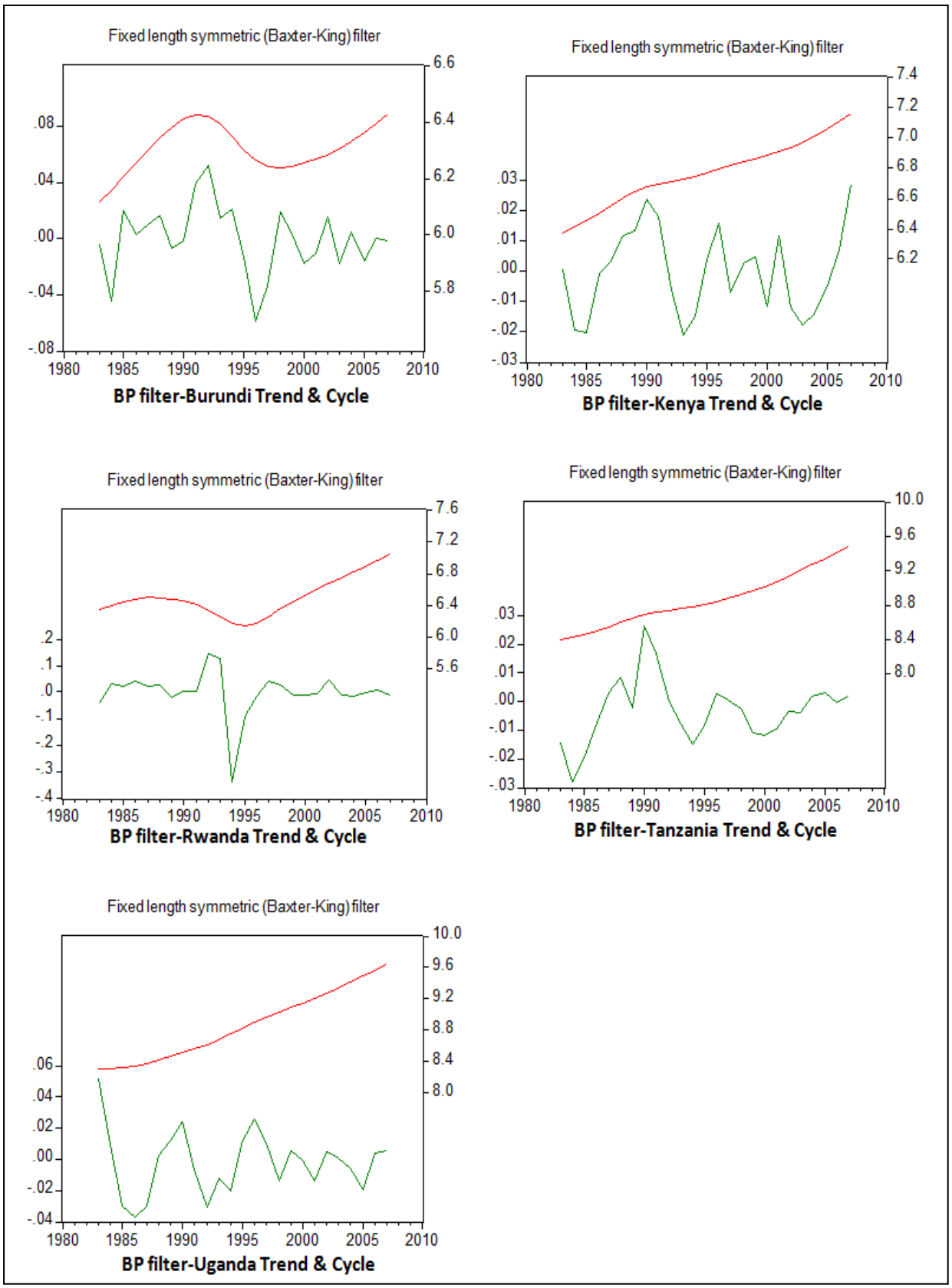


Figure 5-8: Graphical analysis of business cycle turning point approach (BP filter)

5.3.4 Correlation Analysis of Permanent and Transitory Components BP Filter

This section is about correlation analysis of the trend and cyclical component of the GDP for the members of EAC as identified by Baxter and King (BP) method. The sample period of analysis reported in this section is 2001 – 2010, the post EAC formation. The correlation coefficients of the permanent component of the BP filter are similar to those of the HP filter found in section 5.3.2; the only difference is that the correlation of the permanent component in HP filter are slightly higher than those of the BP filter.

Table 5-21: Correlation matrix of the EAC countries permanent component (2001-2010)

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1.000000				
Kenya	0.998875	1.000000			
Rwanda	0.991352	0.994496	1.000000		
Tanzania	0.992870	0.996141	0.999754	1.000000	
Uganda	0.995999	0.998053	0.999060	0.999519	1.000000

Table 5.22 provides the correlation coefficients of the cyclical components of the GDP for the EAC member countries as identified by BP method. The table shows the correlation coefficients for the cyclical component of the BP filter are generally smaller than those found in the HP filler. Based on the cyclical component of the BP filter, Rwandan temporary component got negative correlation with some of the other EAC countries; this result is similar to the results found by HP filter. Kenya also had exhibited smaller correlation coefficients compared to the earlier results of the HP filter. In summary, the two filters (HP vs BP) had shown considerable similarity of the cycle and trend components of GDP.

Table 5-22: Correlation matrix of the EAC countries cycles or irregular component (2001-2010)

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1.000000				
Kenya	0.024462	1.000000			
Rwanda	0.661128	-0.184386	1.000000		
Tanzania	0.113109	0.000101	-0.154733	1.000000	
Uganda	0.579753	0.138756	0.311254	0.058787	1.000000

5.3.5 One-way ANOVA Analysis of Business Cycle

An alternative method of analyzing synchronization of business cycle is the analysis of variance test. It will check the equality of means and variance of the permanent and transitory components between EAC countries. If results show no significant difference in means of the permanent and transitory components, then EAC countries are having similar business cycles and they can form monetary union. Table 5.23 gives the summary of Levene's test of the EAC business cycle of the period 2005-2010[10]. As the table shows the variances of both permanent and transitory components of the GDP of the five east African countries are identical.

Table 5-23: Test of homogeneity of variances in business cycles of EAC 2005-2010

Variable	Levene Statistic		
	df	**Value**	**p-value**
Transitory components (Cycle)	(4, 25)	1,578	0.211
Permanent components (Trend)	(4, 25)	1,936	0.136

[10] The period of 2005 to 2010 is the period after EAC had made Custom Union and Common Market protocol.

Thus, we can proceed to next step of the analysis of variance analysis. Tables 5.24 and 5.25 provide the summary results of both the transitory component and the permanent component. Table 5.24, shows that the transitory component (cycle) of the EAC countries means are similar; in other words, EAC countries do not differ in their temporary component or cycles in this given sample period, thus, we can say EAC countries are having synchronized business cycles.

Table 5-24: ANOVA analysis for transitory components (cycle) in EAC 2005-2010

Transitory components (Cycle)			
EAC Cycle	**SS**	**df**	**Chi-Square**
Between Groups	0.000345	4	8.62E-05
Within Groups	0.007006	25	0.00028
Total	0.007351	29	0.00025
Anova F-statistic	0.007351		
Sig. value	.870		

Table 5.25 presents the test of whether the permanent (trend) components of the EAC countries means are same or not; it shows that EAC member countries are having dissimilar mean as shown by significant p-value (0.000). Thus, we can conclude that EAC countries differ significantly in their growth path, as the analysis of variance test reveals.

Table 5-25: ANOVA analysis for permanent components (trend) in EAC 2005-2010

Permanent components (Trend)			
EAC Cycle	**SS**	**df**	**$\bar{X}$ Square**
Between Groups	54.52625	4	13.63156
Within Groups	0.322784	25	0.012911
Total	54.84904	29	1.891346
Anova F-statistic	1055.78		
Sig. value	.000		

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

This thesis provides a comprehensive assessment of the feasibility of monetary union in East African Community members (EAC). Since the year 2000, EAC members were interested to form monetary union to get economic benefits from that union. However, there is scarcity of comprehensive assessment on the feasibility of monetary union in EAC. Therefore, this study would contribute to the existing meagre empirical literature of EAC monetary union. This chapter is about the summary, conclusion and recommendations of the study. It covers the following topics: section 7.1 summarizes the main findings of the study and makes some conclusion remarks; section 7.2 covered the policy implications of the study and finally section 7.3 proposed some suggestions for the future researchers.

6.1 Summary of the Main Findings

The purpose of this study was to examine the suitability of monetary union in EAC countries. To achieve this goal the study had used the following major techniques: first, descriptive analysis of the socioeconomic background of the region was conducted followed by extensive review of the theoretical foundations and the empirical studies of the optimum currency area; second structural VAR model was used to examine the underlying structural shocks of the EAC economy. Finally, the business cycle synchronization analysis was performed using HP and BP filters.

6.1.1 Social and Macroeconomic Background of the Community

This section highlighted the characteristics of the social and macroeconomic factors of EAC countries. Using available secondary data and information we studied the following seven variables: political system, macroeconomic indicators, factor mobility, macroeconomic convergence criteria, openness, intra-regional trade intensity, similarity of production structure, political will, and diversification of product. Among these, four out of the seven factors indicated that EAC countries might become good candidates for the formation of monetary union; these factors were: political will, openness, intra-regional trade intensity, and similarity of production structure. While, the remaining three factors indicated that poor evidences for the feasibility of monetary union in EAC countries, these factors were: factor mobility, macroeconomic convergence criteria, and diversification of product. In conclusion, although some of the social and macroeconomic variables of EAC showed supporting results for the feasibility of monetary union in the EAC region, but, there are still other essential variables that are yet not supporting the feasibility of monetary union in the EAC region currently. Therefore, EAC countries still need further improvements towards achieving economic convergence before they implement monetary union in the region.

6.1.2 Theoretical Foundations of the OCA

In this section we had reviewed the theory of optimum currency area (OCA) available in the literature. The debate on OCA theory had started in early 1960s and since then huge literature of it had formed. This theory is used to identify how a geographical region could form a monetary union in order to maximize economic efficiency. Thus, in this we summarize the developments of OCA from the early 1960s up to date; also we do a brief review on past empirical studies on African Monetary Union.

The OCA theory is divided into two main parts, “Traditional OCA” theory and so called “New OCA” theory. Traditional OCA theory describes the characteristics of potential monetary union members should possess before they form single currency and surrender their national monetary policy and exchange-rate adjustment. It consists of the following factors: factor mobility, openness, diversification of production, price & wage flexibility, similarity of production & inflation rate etc. Traditional OCA theory emphasizes on costs associated with creating a currency area. It omits positive effects arising from creating such an area.

On the other hand, new OCA theory had emerged and questioned the validity of some traditional OCA properties. As traditional OCA theory proposes, if a group of countries does not fulfil a set of preconditions then it is not wise to form a monetary union; conversely, “New OCA” theory argues that many of the preconditions for monetary union are in fact strengthened by the creation of monetary union. This view states that increased economic integration increases convergence between nations, hence reducing the costs of monetary union in terms of loss of exchange rate policy. Lastly, we had briefly reviewed past empirical studies of monetary union in EAC; we found differing conclusion about the feasibility of monetary union in EAC and the contemporary literature found that EAC had made considerable improvement towards the formation of monetary union in the last decade after they had implemented converging policies in the region.

6.1.3 Structural Vector Auto-regressive Approach

This section examined suitability of a monetary union among the EAC members using four-variable structural vector autoregression model. This model identified four types of shocks: global supply shock, domestic supply shock, monetary supply shock, and domestic demand shocks. To examine the extent to which the shocks are symmetric across the region we use three different methods: 1) correlation analysis, 2) analysis of variance, 3) impulse response analysis, and 4) variance decomposition analysis.

In general, SVAR model gave several conclusion and they are as follows: fist the correlation analysis revealed that the macroeconomic shocks of EAC members had improved in the period after the formation East African treaty. In this period, the domestic demand shock and global supply shock in the region were strong and affects symmetrically; while, the domestic supply shock of the region, with the exception of Kenya, had also shown relatively symmetric shocks in the region. But, the monetary shocks of the EAC region – although improved in the last decade – had shown relatively less dominance and asymmetry, as Burundi and some of the Tanzanian monetary shocks are negatively correlated with the rest of EAC countries. Secondly, similar to the correlation analysis, the one-way Anova had shown similarity in external supply shock, domestic supply shock and domestic demand shocks of the EAC countries, while, monetary shocks of the region had shown inconclusive results. Finally, the impulse response function and the variance decomposition results did not show strong pattern of responses to shocks, therefore, the likelihood of a successful monetary union in EAC region is doubtful.

6.1.4 Business Cycle Synchronization Approach

This section empirically assessed the suitability of monetary union in East African community members on the basis of business cycle synchronization. This research considers annual GDP (gross domestic product) data from IMF (international monetary fund) for the period of 1980 to 2010. In order to extract the business cycles and trends, the study uses HP (Hodrick-Prescott) and the BP (band pass) filters. After identifying the cycles and trends of the business cycle, the study considers cross country correlation analysis and analysis of variance technique to examine whether EAC (East African community) countries are characterized by synchronized business cycles or not.

The results show that four EAC countries (Burundi, Kenya, Tanzania and Uganda) among five countries are having similar pattern of business cycle and trend from the last ten years of the formation of the EAC. The research concludes that these countries, except Rwanda, do not differ significantly in transitory or cycle components but do differ in permanent components especially in growth trend. To compare business cycle synchronization model and structural vector auto-regression model of macroeconomic shock analysis, we found that business cycle synchronization results and analysis were better than the macroeconomic shock analysis of SVAR model.

6.2 Conclusion Remarks and Policy Implication

The present challenges posed in the Euro Area shows that monetary union had many weaknesses if a political union and a financial union do not occur in tandem with monetary union. Although the root cause to the Euro Area Crisis was originated from the Global Financial Crisis of 2008, the many problems faced by these member countries (Greece went bankrupt) suggest that a monetary union is not ideal if member countries are too heterogeneous. Moreover, the modern problems facing markets today are more global in nature due to markets interconnectedness, market distortions, financial frictions, liquidity risks, and systemic risks. Thus, monetary union for a region is thus not a panacea to solve economic problems of a community.

The formation of the euro currency was fundamentally always a political project driven by strong political will which aimed to cement peace and unity in Europe and to remove the continent's history of conflicts, wars and bloodshed; therefore, the formation of euro currency was a premature decision as they have not fully met the criterion of optimum currency area (Feldstein, M. 1997). Similarly, EAC is also driven by strong political will which is aimed to ensure peace and stability in the region as the region had experienced some major conflicts in the past. It is believed that a deeper regional integration can play a major role in promoting regional stability as well as offer a discussion platform for common political problems and external threats.

The present Euro crisis might be attributed to the differences in economic convergence between the more mature economies of the north European countries and the less mature ones of the south European countries. The inclusion of Greece, Portugal, and Spain into Eurozone was a great mistake because these countries are nothing like Germany and the rest of Northern Europe; these countries have exaggerated their

macroeconomic convergence criteria of joining euro currency area. EAC countries are planning to admit South Sudan to join into the EAC bloc, which is the same mistake done by Europe; therefore, EAC should be more careful about the enlargement of the monetary area and not to allow countries that have not met properly the convergence criteria.

On the other hand, EAC countries should learn lessons from the eurozone which lucks effective institutions that implement fiscal discipline to redistribute funds to a member countries affected by an adverse country-specific disturbance. The core-periphery discrepancy is an issue the eurozone must face. Fiscal transfers from the core to the periphery need to be institutionalised - as in the world's other large currency union, the United States.

Based on the findings of this study, we draw the following the policy implications were presented with cautious

- According to the results, we found that the macroeconomic convergence of the EAC region was weak. There, we recommend that EAC countries should concentrate seriously in adopting the macroeconomic convergence criteria in which they had agreed on in Entebbe-Uganda 2007. The macroeconomic asymmetric shocks existing in the EAC can be reduced by achieving the minimal annual macroeconomic convergence criteria.
- In the results, we found that the factor mobility – labour and capital movements – between the EAC countries was invisible. As factor mobility is a crucial prerequisite for the formation of currency union, we recommend to the EAC policy makers to open their borders for the free movement of goods, services

and labour. Free movement of labour and capital would play a big in adjusting when shock occurs in the region.

- Although, both the SVAR model and the business cycle synchronization model had shown considerable improvement of shocks, cycles and trends among EAC countries in the last decade; but on the other, they made several tentative conclusions towards the possibility of monetary union in the region. Therefore, we suggest for the EAC partner states to strengthen the cooperation in the field of monetary and exchange rate policy to achieve macroeconomic symmetric shocks as well as synchronized business cycle. Developing a common financial market infrastructure as well as adaptation of policy harmonization in the financial markets would help to remove the macro-economic disharmonies which may exist among the EAC member states.
- To achieve the maximum welfare of a monetary union, it is necessary to promote the intra-regional trade share of the candidates of a monetary union, as this would generate synchronization of business cycle in the region. According to the endogeneity of OCA theory, it argues that highly intra-traded countries would become more integrated after forming a monetary union despite unsatisfied with some of the OCA criteria. Thus, we recommend EAC countries to increase the intra-regional trade share and regional policy co-ordinations in order to achieve the higher level of synchronization of symmetry in their economies and business cycles.
- Preparation for monetary union will require effective institutions for macroeconomic surveillance and enforcing fiscal discipline, because euro zone experiences indicate that these institutions will be difficult to design and take a considerable time to become effective.

In conclusion, this thesis addressed an interesting issue, which is monetary union. Currency union is much debated and received much attention from scholars and policymakers today as it is the challenges that faced by the countries in the Eurozone. The Eurozone crisis provide lesson to some countries not to be very ambitious with the idea of country union despite the theoretical analysis of its feasibility. The unionism of the currency it does not mean that difficulty of one country will be ailed out by other countries in the union. This thesis provides more understanding to readers on assessing the feasibility of the monetary union in the EAC.

6.3 Suggestions for Future Researchers

Based on our findings we suggest the following recommendations for the future researchers to improve the field:

- Recommendations for future researchers: This study had concentrated on the symmetry of shock analysis; though this is important, it is only one aspect of monetary union, it would be better to use a more comprehensive estimate such as the welfare effects of the proposed monetary union; and to apply more rigorous methods like computable general equilibrium methods, dynamic stochastic general equilibrium etc., these models are micro-founded optimization-based models that have become very popular in macroeconomics over the past 25 years.
- This study did not consider any trade analysis; considering intra-regional trade and comparative advantage analysis would be much better to understand well the prospects of monetary union in East African Community. Also, it is would be better to include trade variable in the modelling of structural VAR.

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APPENDIX A


TUNISIA
MOROCCO
ALGERIA
L I B Y A
EGYPT
MAURITANIA
MALI
NIGER
SENEGAL
CHAD
SUDAN
ERITREA
BURKINA FASO
GUINEA
BENIN
NIGERIA
A f r i c a
ETHIOPIA
CÔTE D'IVOIRE
GHANA
C.A.R.
CAMEROON
UGANDA
SOMALIA
REP. OF CONGO
KENYA
GABON
CONGO (DRC)
TANZANIA
ZAMBIA
ANGOLA
MOZAMBIQUE
ZIMBABWE
NAMIBIA
BOTSWANA
SOUTH AFRICA

Appendix B

IMPULSE RESPONSE TO GENERALIZED ONE S.D. INNOVATIONS

1- BURUNDI

Response of LYW:

Period	LYW	LY1	LR1	LP1
1	0.048183	6.07E-05	-0.013701	-0.002356
	(0.00633)	(0.00895)	(0.00876)	(0.00894)
2	0.038260	0.005683	0.000445	-0.006111
	(0.00788)	(0.00884)	(0.01055)	(0.00850)
3	0.029644	0.011699	0.010497	-0.009100
	(0.01007)	(0.01032)	(0.01519)	(0.01027)
4	0.022451	0.017733	0.016928	-0.011369
	(0.01153)	(0.01202)	(0.02017)	(0.01284)
5	0.016698	0.023497	0.020274	-0.012987
	(0.01280)	(0.01392)	(0.02499)	(0.01557)
6	0.012325	0.028784	0.021100	-0.014038
	(0.01422)	(0.01613)	(0.02956)	(0.01833)
7	0.009217	0.033462	0.019957	-0.014614
	(0.01579)	(0.01869)	(0.03384)	(0.02109)
8	0.007225	0.037458	0.017363	-0.014807
	(0.01740)	(0.02154)	(0.03782)	(0.02384)
9	0.006181	0.040750	0.013783	-0.014706
	(0.01896)	(0.02459)	(0.04146)	(0.02656)
10	0.005908	0.043355	0.009620	-0.014392
	(0.02045)	(0.02778)	(0.04469)	(0.02919)

Response of LY1:

Period	LYW	LY1	LR1	LP1
1	4.65E-05	0.036910	-0.006245	-0.015938
	(0.00685)	(0.00485)	(0.00680)	(0.00653)
2	0.000389	0.036721	-0.009333	-0.014748
	(0.00803)	(0.00601)	(0.00877)	(0.00723)
3	0.001069	0.036100	-0.012262	-0.013563
	(0.00968)	(0.00805)	(0.01309)	(0.00905)
4	0.001955	0.035132	-0.014879	-0.012422
	(0.01087)	(0.01010)	(0.01810)	(0.01152)
5	0.002936	0.033897	-0.017086	-0.011352
	(0.01168)	(0.01212)	(0.02309)	(0.01422)
6	0.003926	0.032476	-0.018830	-0.010372
	(0.01237)	(0.01424)	(0.02765)	(0.01692)
7	0.004860	0.030938	-0.020098	-0.009494
	(0.01315)	(0.01656)	(0.03151)	(0.01946)
8	0.005691	0.029346	-0.020904	-0.008721
	(0.01409)	(0.01910)	(0.03451)	(0.02175)
9	0.006391	0.027751	-0.021285	-0.008051
	(0.01518)	(0.02178)	(0.03659)	(0.02374)
10	0.006944	0.026194	-0.021289	-0.007479
	(0.01631)	(0.02453)	(0.03776)	(0.02541)

Response of LR1:

Period	LYW	LY1	LR1	LP1
1	-0.027159	-0.016160	0.095510	-0.004923
	(0.01737)	(0.01761)	(0.01254)	(0.01772)
2	-0.027413	-0.008198	0.084126	-0.004626
	(0.01873)	(0.01813)	(0.01832)	(0.01751)
3	-0.026181	-0.001883	0.072146	-0.003956
	(0.02116)	(0.02063)	(0.02925)	(0.02040)
4	-0.023860	0.002949	0.060235	-0.003065
	(0.02196)	(0.02308)	(0.03979)	(0.02469)
5	-0.020808	0.006493	0.048898	-0.002079
	(0.02168)	(0.02538)	(0.04848)	(0.02900)
6	-0.017332	0.008954	0.038493	-0.001096
	(0.02143)	(0.02792)	(0.05461)	(0.03260)
7	-0.013687	0.010540	0.029247	-0.000189
	(0.02199)	(0.03095)	(0.05784)	(0.03519)
8	-0.010078	0.011447	0.021279	0.000593
	(0.02339)	(0.03435)	(0.05821)	(0.03666)
9	-0.006656	0.011853	0.014618	0.001217
	(0.02515)	(0.03783)	(0.05601)	(0.03707)
10	-0.003530	0.011914	0.009225	0.001672
	(0.02672)	(0.04100)	(0.05173)	(0.03652)

Response of LP1:

Period	LYW	LY1	LR1	LP1
1	-0.003024	-0.026704	-0.003188	0.061843
	(0.01148)	(0.01094)	(0.01148)	(0.00812)
2	0.013379	-0.033978	-0.010868	0.060035
	(0.01354)	(0.01234)	(0.01496)	(0.01002)
3	0.025093	-0.039265	-0.011943	0.056907
	(0.01644)	(0.01537)	(0.02242)	(0.01416)
4	0.032787	-0.042415	-0.008307	0.052798
	(0.01869)	(0.01864)	(0.03113)	(0.01903)
5	0.037158	-0.043443	-0.001610	0.048021
	(0.02039)	(0.02204)	(0.03997)	(0.02411)
6	0.038895	-0.042485	0.006763	0.042855
	(0.02189)	(0.02569)	(0.04819)	(0.02910)
7	0.038646	-0.039758	0.015696	0.037533
	(0.02353)	(0.02971)	(0.05527)	(0.03379)
8	0.036992	-0.035534	0.024332	0.032250
	(0.02549)	(0.03412)	(0.06090)	(0.03800)
9	0.034442	-0.030109	0.032051	0.027154
	(0.02778)	(0.03884)	(0.06498)	(0.04165)
10	0.031417	-0.023782	0.038443	0.022357
	(0.03024)	(0.04371)	(0.06760)	(0.04472)

Generalized Impulse
Standard Errors: Analytic

2- KENYA

Response of LYW:

Period	LYW	LY2	LR2	LP2
1	0.051117	0.036120	-0.022975	-0.004704
	(0.00671)	(0.00822)	(0.00900)	(0.00947)
2	0.044313	0.036943	-0.013371	-0.008139
	(0.00922)	(0.00788)	(0.01010)	(0.00892)
3	0.041148	0.037048	-0.006015	-0.009831
	(0.01162)	(0.00952)	(0.01354)	(0.00955)
4	0.039189	0.036655	0.000199	-0.010738
	(0.01355)	(0.01165)	(0.01747)	(0.01057)
5	0.037518	0.035875	0.005685	-0.011241
	(0.01540)	(0.01386)	(0.02142)	(0.01175)
6	0.035805	0.034773	0.010590	-0.011495
	(0.01723)	(0.01603)	(0.02527)	(0.01297)
7	0.033948	0.033400	0.014965	-0.011567
	(0.01900)	(0.01812)	(0.02898)	(0.01418)
8	0.031930	0.031798	0.018826	-0.011493
	(0.02068)	(0.02011)	(0.03252)	(0.01535)
9	0.029770	0.030005	0.022181	-0.011294
	(0.02226)	(0.02199)	(0.03586)	(0.01643)
10	0.027496	0.028059	0.025038	-0.010987
	(0.02373)	(0.02373)	(0.03896)	(0.01742)

Response of LY2:

Period	LYW	LY2	LR2	LP2
1	0.014037	0.019865	-0.007789	-0.007275
	(0.00320)	(0.00261)	(0.00354)	(0.00356)
2	0.018427	0.019801	-0.006283	-0.006095
	(0.00406)	(0.00325)	(0.00442)	(0.00399)
3	0.019892	0.019707	-0.003712	-0.005845
	(0.00528)	(0.00430)	(0.00609)	(0.00457)
4	0.020109	0.019481	-0.000869	-0.005898
	(0.00641)	(0.00545)	(0.00805)	(0.00517)
5	0.019743	0.019096	0.001929	-0.006015
	(0.00748)	(0.00663)	(0.01011)	(0.00581)
6	0.019066	0.018556	0.004552	-0.006106
	(0.00849)	(0.00781)	(0.01217)	(0.00647)
7	0.018195	0.017872	0.006944	-0.006141
	(0.00947)	(0.00895)	(0.01418)	(0.00712)
8	0.017189	0.017064	0.009084	-0.006113
	(0.01039)	(0.01003)	(0.01611)	(0.00776)
9	0.016085	0.016149	0.010962	-0.006022
	(0.01126)	(0.01106)	(0.01794)	(0.00835)
10	0.014908	0.015148	0.012576	-0.005875
	(0.01206)	(0.01202)	(0.01965)	(0.00890)

Response of LR2:

Period	LYW	LY2	LR2	LP2
1	-0.042725	-0.037270	0.095058	0.014744
	(0.01674)	(0.01696)	(0.01248)	(0.01755)
2	-0.044061	-0.038640	0.080129	0.015296
	(0.01876)	(0.01565)	(0.01506)	(0.01580)
3	-0.044303	-0.039417	0.066101	0.015826
	(0.02078)	(0.01667)	(0.02149)	(0.01512)
4	-0.043822	-0.039637	0.053109	0.016224
	(0.02150)	(0.01843)	(0.02757)	(0.01502)
5	-0.042798	-0.039347	0.041194	0.016456
	(0.02183)	(0.02007)	(0.03234)	(0.01526)
6	-0.041336	-0.038601	0.030358	0.016519
	(0.02211)	(0.02133)	(0.03576)	(0.01559)
7	-0.039511	-0.037454	0.020582	0.016418
	(0.02244)	(0.02219)	(0.03803)	(0.01589)
8	-0.037388	-0.035959	0.011839	0.016166
	(0.02284)	(0.02275)	(0.03941)	(0.01608)
9	-0.035021	-0.034170	0.004095	0.015777
	(0.02335)	(0.02315)	(0.04017)	(0.01618)
10	-0.032464	-0.032136	-0.002689	0.015266
	(0.02398)	(0.02350)	(0.04054)	(0.01620)

Response of LP2:

Period	LYW	LY2	LR2	LP2
1	-0.002754	-0.010960	0.004642	0.029926
	(0.00555)	(0.00537)	(0.00552)	(0.00393)
2	0.001993	-0.004266	-0.002918	0.025190
	(0.00630)	(0.00530)	(0.00591)	(0.00398)
3	0.007597	0.001963	-0.008851	0.021130
	(0.00721)	(0.00603)	(0.00765)	(0.00464)
4	0.013186	0.007738	-0.013049	0.017448
	(0.00791)	(0.00698)	(0.00968)	(0.00548)
5	0.018409	0.013040	-0.015624	0.014036
	(0.00866)	(0.00796)	(0.01172)	(0.00635)
6	0.023125	0.017849	-0.016762	0.010859
	(0.00950)	(0.00895)	(0.01374)	(0.00722)
7	0.027277	0.022148	-0.016666	0.007910
	(0.01045)	(0.00998)	(0.01576)	(0.00808)
8	0.030847	0.025926	-0.015536	0.005189
	(0.01150)	(0.01108)	(0.01783)	(0.00895)
9	0.033835	0.029178	-0.013562	0.002699
	(0.01267)	(0.01226)	(0.01998)	(0.00985)
10	0.036252	0.031909	-0.010917	0.000441
	(0.01395)	(0.01355)	(0.02221)	(0.01078)

Generalized Impulse
Standard Errors: Analytic

3- RWANDA

Response of LYW:

Period	LYW	LY3	LR3	LP3
1	0.052231	0.006852	-0.009142	-0.011304
	(0.00711)	(0.01001)	(0.00997)	(0.00993)
2	0.051809	0.011499	-0.003000	-0.016152
	(0.00833)	(0.01036)	(0.01194)	(0.01070)
3	0.050390	0.014612	0.002960	-0.019312
	(0.01088)	(0.01132)	(0.01607)	(0.01278)
4	0.048424	0.016395	0.008732	-0.021253
	(0.01376)	(0.01270)	(0.02087)	(0.01566)
5	0.046282	0.017065	0.014305	-0.022395
	(0.01666)	(0.01434)	(0.02572)	(0.01904)
6	0.044258	0.016840	0.019662	-0.023103
	(0.01953)	(0.01610)	(0.03042)	(0.02282)
7	0.042569	0.015928	0.024781	-0.023679
	(0.02238)	(0.01788)	(0.03488)	(0.02695)
8	0.041361	0.014526	0.029637	-0.024363
	(0.02525)	(0.01962)	(0.03908)	(0.03142)
9	0.040716	0.012811	0.034198	-0.025331
	(0.02817)	(0.02128)	(0.04305)	(0.03621)
10	0.040661	0.010940	0.038430	-0.026701
	(0.03111)	(0.02285)	(0.04681)	(0.04129)

Response of LY3:

Period	LYW	LY3	LR3	LP3
1	0.005623	0.042865	-0.007688	-0.015057
	(0.00821)	(0.00583)	(0.00818)	(0.00799)
2	-0.004993	0.035614	-0.004518	-0.002451
	(0.00803)	(0.00593)	(0.00897)	(0.00806)
3	-0.012808	0.028242	-0.001069	0.008046
	(0.00909)	(0.00719)	(0.01182)	(0.00936)
4	-0.017895	0.021058	0.002623	0.016235
	(0.01054)	(0.00864)	(0.01492)	(0.01111)
5	-0.020418	0.014308	0.006513	0.022044
	(0.01206)	(0.00992)	(0.01784)	(0.01309)
6	-0.020618	0.008178	0.010542	0.025500
	(0.01357)	(0.01097)	(0.02046)	(0.01523)
7	-0.018785	0.002799	0.014646	0.026719
	(0.01503)	(0.01178)	(0.02274)	(0.01751)
8	-0.015243	-0.001749	0.018756	0.025884
	(0.01643)	(0.01240)	(0.02461)	(0.01987)
9	-0.010333	-0.005430	0.022800	0.023227
	(0.01774)	(0.01286)	(0.02600)	(0.02226)
10	-0.004398	-0.008245	0.026705	0.019016
	(0.01896)	(0.01323)	(0.02690)	(0.02461)

Response of LR3:

Period	LYW	LY3	LR3	LP3
1	-0.014826	-0.015193	0.084707	-0.000780
	(0.01618)	(0.01617)	(0.01153)	(0.01630)
2	-0.004727	-0.022289	0.084305	-0.006085
	(0.01774)	(0.01677)	(0.01567)	(0.01776)
3	0.006557	-0.026790	0.083288	-0.014074
	(0.02123)	(0.01872)	(0.02385)	(0.02147)
4	0.018170	-0.028995	0.081578	-0.023853
	(0.02558)	(0.02160)	(0.03293)	(0.02655)
5	0.029374	-0.029235	0.079118	-0.034592
	(0.03033)	(0.02503)	(0.04217)	(0.03257)
6	0.039562	-0.027855	0.075870	-0.045541
	(0.03531)	(0.02868)	(0.05136)	(0.03934)
7	0.048255	-0.025200	0.071817	-0.056051
	(0.04046)	(0.03232)	(0.06037)	(0.04681)
8	0.055102	-0.021601	0.066963	-0.065572
	(0.04572)	(0.03577)	(0.06905)	(0.05490)
9	0.059869	-0.017368	0.061330	-0.073667
	(0.05100)	(0.03887)	(0.07723)	(0.06350)
10	0.062430	-0.012778	0.054962	-0.080001
	(0.05615)	(0.04152)	(0.08467)	(0.07245)

Response of LP3:

Period	LYW	LY3	LR3	LP3
1	-0.014440	-0.023436	-0.000614	0.066721
	(0.01269)	(0.01244)	(0.01284)	(0.00908)
2	-0.001419	-0.021511	0.008593	0.053222
	(0.01186)	(0.01082)	(0.01334)	(0.00943)
3	0.011044	-0.019409	0.017568	0.039619
	(0.01306)	(0.01104)	(0.01708)	(0.01229)
4	0.022843	-0.017192	0.026213	0.026077
	(0.01507)	(0.01258)	(0.02124)	(0.01580)
5	0.033889	-0.014913	0.034440	0.012742
	(0.01749)	(0.01487)	(0.02525)	(0.01954)
6	0.044111	-0.012616	0.042163	-0.000254
	(0.02040)	(0.01758)	(0.02940)	(0.02361)
7	0.053451	-0.010335	0.049308	-0.012797
	(0.02394)	(0.02061)	(0.03417)	(0.02818)
8	0.061862	-0.008100	0.055806	-0.024784
	(0.02817)	(0.02392)	(0.03994)	(0.03343)
9	0.069311	-0.005933	0.061597	-0.036124
	(0.03306)	(0.02752)	(0.04692)	(0.03946)
10	0.075772	-0.003851	0.066629	-0.046736
	(0.03850)	(0.03137)	(0.05508)	(0.04635)

Generalized Impulse
Standard Errors: Analytic

4- TANZANIA

Response of LYW:

Period	LYW	LY4	LR4	LP4
1	0.043737	0.018524	0.011077	0.003089
	(0.00584)	(0.00789)	(0.00813)	(0.00826)
2	0.052922	0.029875	0.026079	-0.001378
	(0.01269)	(0.01272)	(0.01332)	(0.01377)
3	0.040673	0.034197	0.032283	0.000750
	(0.01784)	(0.01612)	(0.01587)	(0.01354)
4	0.023593	0.036452	0.028125	0.003864
	(0.02081)	(0.01795)	(0.01856)	(0.01348)
5	0.012349	0.038571	0.011645	0.008817
	(0.02320)	(0.01917)	(0.02170)	(0.01318)
6	0.008330	0.039890	-0.012347	0.013387
	(0.02327)	(0.01970)	(0.02483)	(0.01302)
7	0.007545	0.038381	-0.037056	0.016897
	(0.02296)	(0.02048)	(0.02807)	(0.01427)
8	0.005847	0.032978	-0.055607	0.018673
	(0.02489)	(0.02255)	(0.03149)	(0.01658)
9	0.002075	0.024517	-0.063743	0.018698
	(0.02728)	(0.02526)	(0.03465)	(0.01812)
10	-0.002023	0.015395	-0.060494	0.017212
	(0.02847)	(0.02742)	(0.03721)	(0.01794)

Response of LY4:

Period	LYW	LY4	LR4	LP4
1	0.005676	0.013401	-0.001640	-0.001852
	(0.00242)	(0.00179)	(0.00252)	(0.00252)
2	0.011099	0.020753	0.001998	-0.003267
	(0.00483)	(0.00384)	(0.00484)	(0.00483)
3	0.011370	0.025313	0.001239	-0.001537
	(0.00733)	(0.00600)	(0.00680)	(0.00602)
4	0.008485	0.028151	-0.003421	0.000369
	(0.00930)	(0.00792)	(0.00874)	(0.00706)
5	0.005077	0.029518	-0.011953	0.002946
	(0.01100)	(0.00972)	(0.01069)	(0.00793)
6	0.002409	0.029528	-0.022238	0.005311
	(0.01255)	(0.01154)	(0.01286)	(0.00907)
7	0.000565	0.028137	-0.031904	0.007221
	(0.01397)	(0.01341)	(0.01529)	(0.01038)
8	-0.000793	0.025544	-0.038630	0.008380
	(0.01533)	(0.01521)	(0.01782)	(0.01155)
9	-0.001750	0.022321	-0.041028	0.008775
	(0.01650)	(0.01669)	(0.02016)	(0.01217)
10	-0.002008	0.019327	-0.038867	0.008517
	(0.01710)	(0.01757)	(0.02203)	(0.01207)

Response of LR4:

Period	LYW	LY4	LR4	LP4
1	0.028680	-0.013855	0.113237	-0.015384
	(0.02105)	(0.02132)	(0.01513)	(0.02130)
2	0.038177	0.003652	0.139072	-0.000476
	(0.03704)	(0.03428)	(0.03012)	(0.03542)
3	0.050136	0.031166	0.135721	-0.000486
	(0.04842)	(0.04396)	(0.03931)	(0.03581)
4	0.059160	0.053792	0.096587	0.009337
	(0.05316)	(0.04798)	(0.04738)	(0.03442)
5	0.056677	0.064898	0.040996	0.017372
	(0.05553)	(0.04786)	(0.05349)	(0.02862)
6	0.041317	0.061129	-0.018941	0.025765
	(0.05488)	(0.04585)	(0.06036)	(0.02551)
7	0.018088	0.044754	-0.068928	0.031170
	(0.05127)	(0.04426)	(0.06848)	(0.02682)
8	-0.004877	0.021027	-0.099802	0.033101
	(0.04992)	(0.04572)	(0.07658)	(0.03003)
9	-0.020611	-0.003667	-0.106584	0.030922
	(0.05331)	(0.05023)	(0.08267)	(0.03176)
10	-0.025667	-0.023798	-0.089691	0.025272
	(0.05661)	(0.05459)	(0.08610)	(0.03032)

Response of LP4:

Period	LYW	LY4	LR4	LP4
1	0.006898	-0.013496	-0.013267	0.097654
	(0.01843)	(0.01837)	(0.01837)	(0.01305)
2	0.045053	0.011239	0.057631	0.045882
	(0.02680)	(0.02421)	(0.02423)	(0.02470)
3	0.090854	0.036896	0.071154	0.058348
	(0.03278)	(0.03095)	(0.03041)	(0.02709)
4	0.116924	0.062269	0.083120	0.048799
	(0.04321)	(0.04099)	(0.04081)	(0.03453)
5	0.119260	0.077287	0.071458	0.053069
	(0.05125)	(0.04868)	(0.05057)	(0.03719)
6	0.104059	0.082928	0.047346	0.055914
	(0.05492)	(0.05288)	(0.05866)	(0.03662)
7	0.082488	0.080141	0.011590	0.061617
	(0.05573)	(0.05413)	(0.06586)	(0.03430)
8	0.062516	0.071155	-0.026794	0.065911
	(0.05366)	(0.05346)	(0.07275)	(0.03300)
9	0.047491	0.057505	-0.059568	0.068250
	(0.05017)	(0.05245)	(0.07893)	(0.03311)
10	0.037421	0.041033	-0.078754	0.067432
	(0.04863)	(0.05256)	(0.08348)	(0.03384)

Generalized Impulse
Standard Errors: Analytic

5- UGANDA

Response of LYW:

Period	LYW	LY5	LR5	LP5
1	0.046244	0.021776	-0.015781	0.003380
	(0.00618)	(0.00824)	(0.00848)	(0.00873)
2	0.060432	0.030358	-0.024138	0.016365
	(0.01359)	(0.01505)	(0.01447)	(0.01408)
3	0.059309	0.028580	-0.022703	0.019038
	(0.01943)	(0.01961)	(0.01994)	(0.01684)
4	0.050249	0.023433	-0.014734	0.017927
	(0.02390)	(0.01950)	(0.02303)	(0.01658)
5	0.037280	0.018312	-0.007012	0.016870
	(0.02731)	(0.01678)	(0.02296)	(0.01439)
6	0.024556	0.014460	-0.002970	0.015837
	(0.02761)	(0.01407)	(0.02034)	(0.01250)
7	0.015609	0.012147	-0.002643	0.014422
	(0.02419)	(0.01358)	(0.01668)	(0.01167)
8	0.012047	0.011119	-0.004689	0.012962
	(0.01966)	(0.01543)	(0.01376)	(0.01101)
9	0.013264	0.010809	-0.007579	0.012033
	(0.01928)	(0.01778)	(0.01259)	(0.00988)
10	0.017099	0.010570	-0.010011	0.011879
	(0.02359)	(0.01925)	(0.01235)	(0.00857)

Response of LY5:

Period	LYW	LY5	LR5	LP5
1	0.012441	0.026419	-0.007874	0.003802
	(0.00471)	(0.00353)	(0.00488)	(0.00497)
2	0.019115	0.034173	-0.014103	0.003029
	(0.00858)	(0.00755)	(0.00818)	(0.00805)
3	0.032335	0.036148	-0.018347	0.002085
	(0.01175)	(0.01096)	(0.01184)	(0.01042)
4	0.047795	0.036361	-0.021382	0.005128
	(0.01555)	(0.01360)	(0.01559)	(0.01273)
5	0.058933	0.034863	-0.022450	0.010306
	(0.02030)	(0.01672)	(0.01925)	(0.01522)
6	0.061937	0.031478	-0.020400	0.014918
	(0.02444)	(0.01936)	(0.02239)	(0.01720)
7	0.056533	0.026745	-0.015640	0.017663
	(0.02701)	(0.02028)	(0.02422)	(0.01775)
8	0.045310	0.021676	-0.010045	0.018425
	(0.02777)	(0.01956)	(0.02410)	(0.01681)
9	0.032325	0.017265	-0.005683	0.017662
	(0.02682)	(0.01857)	(0.02208)	(0.01509)
10	0.021476	0.014122	-0.003776	0.016068
	(0.02488)	(0.01886)	(0.01894)	(0.01339)

Response of LR5:

Period	LYW	LY5	LR5	LP5
1	-0.051090	-0.044623	0.149711	-0.051642
	(0.02746)	(0.02766)	(0.02001)	(0.02744)
2	-0.096185	-0.030398	0.119398	0.010484
	(0.04235)	(0.04322)	(0.03728)	(0.03827)
3	-0.100811	-0.010612	0.032960	0.031399
	(0.04780)	(0.04551)	(0.04767)	(0.03837)
4	-0.056730	0.006411	-0.027665	0.020188
	(0.05377)	(0.03708)	(0.04771)	(0.03273)
5	0.010578	0.018407	-0.053738	0.011706
	(0.05632)	(0.03049)	(0.04109)	(0.02719)
6	0.069171	0.023141	-0.057846	0.016292
	(0.05406)	(0.03231)	(0.03554)	(0.02825)
7	0.097968	0.019836	-0.048136	0.026897
	(0.05656)	(0.04205)	(0.03852)	(0.03238)
8	0.091621	0.010278	-0.029141	0.034720
	(0.06867)	(0.04914)	(0.04642)	(0.03369)
9	0.058224	-0.001786	-0.006754	0.035788
	(0.08355)	(0.04746)	(0.05108)	(0.03000)
10	0.013552	-0.012254	0.011825	0.030581
	(0.09170)	(0.03759)	(0.04889)	(0.02475)

Response of LP5:

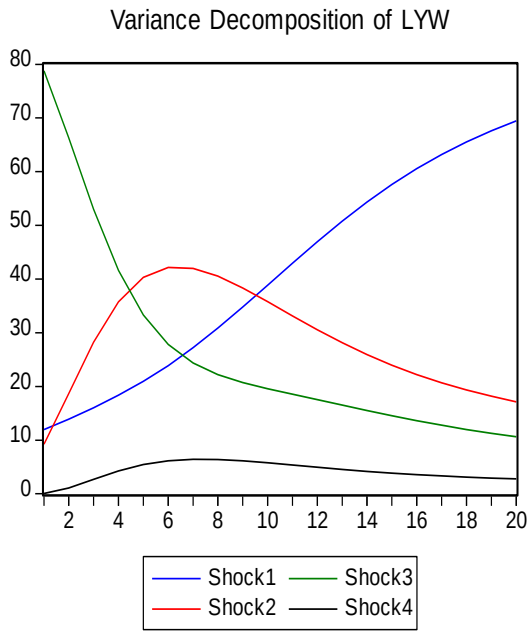
Period	LYW	LY5	LR5	LP5
1	0.011543	0.022733	-0.054484	0.157951
	(0.02981)	(0.02969)	(0.02895)	(0.02111)
2	0.088294	0.013559	-0.136468	0.166160
	(0.05157)	(0.05208)	(0.04600)	(0.04193)
3	0.166891	0.003057	-0.149453	0.155288
	(0.07107)	(0.07119)	(0.06899)	(0.05954)
4	0.191781	-0.015140	-0.115872	0.153582
	(0.09459)	(0.08488)	(0.09055)	(0.07091)
5	0.151022	-0.040949	-0.064301	0.151693
	(0.11503)	(0.08851)	(0.10319)	(0.07305)
6	0.064520	-0.067965	-0.013591	0.139920
	(0.12557)	(0.08030)	(0.10398)	(0.06749)
7	-0.033951	-0.088849	0.023457	0.117471
	(0.12314)	(0.07017)	(0.09490)	(0.06157)
8	-0.112436	-0.098979	0.039739	0.089629
	(0.11104)	(0.07400)	(0.08365)	(0.06175)
9	-0.151493	-0.097853	0.035427	0.063044
	(0.10515)	(0.09024)	(0.07995)	(0.06398)
10	-0.148382	-0.088585	0.017401	0.042650
	(0.12294)	(0.10456)	(0.08465)	(0.06141)

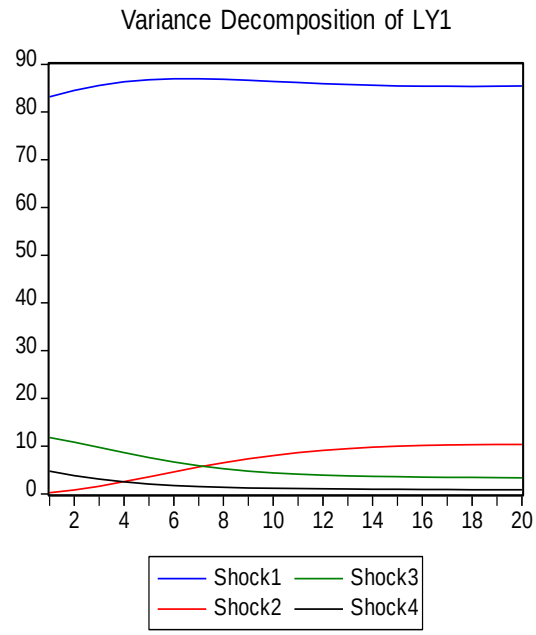
Generalized Impulse
Standard Errors: Analytic

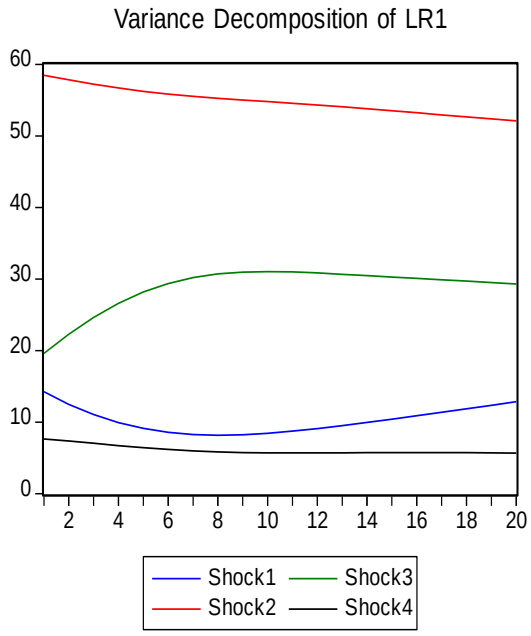
Appendix C

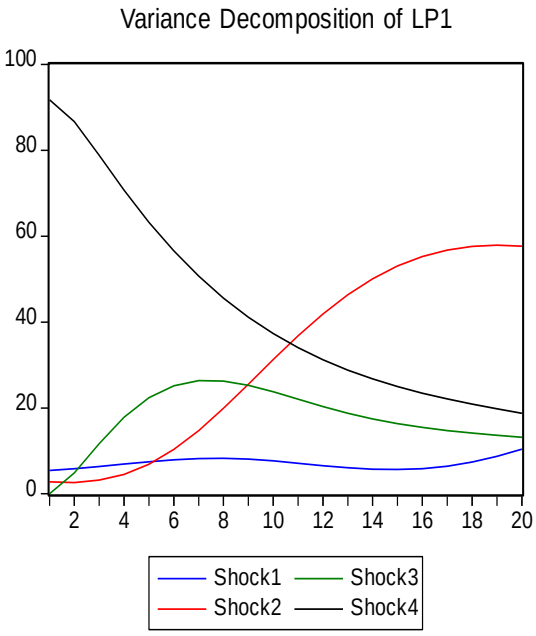
VARIANCE DECOMPOSITION RESULTS

1- BURUNDI

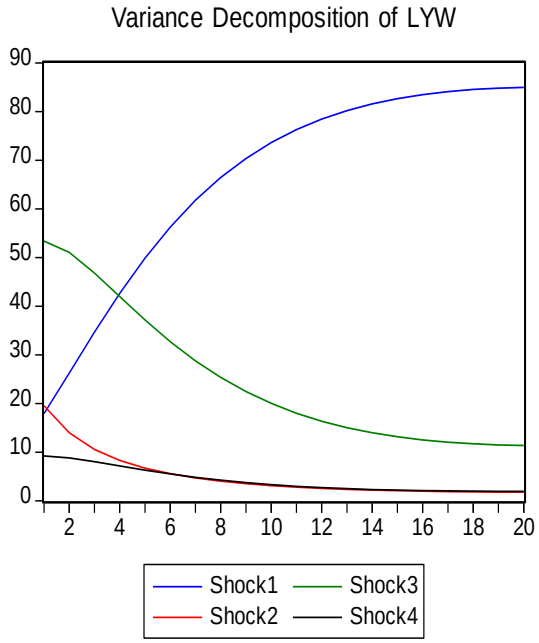


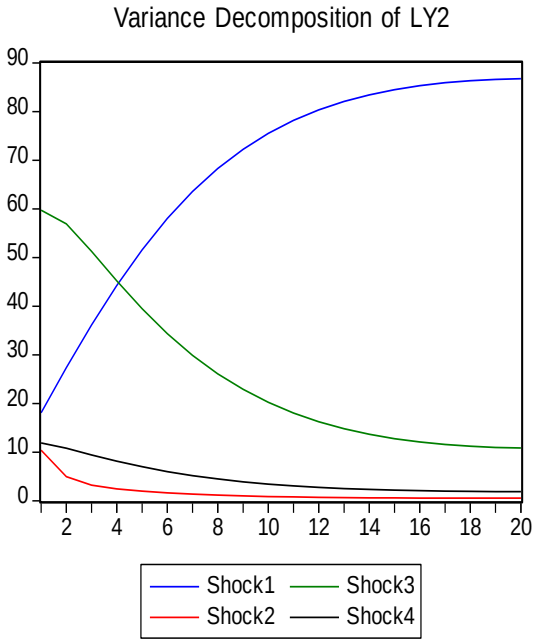


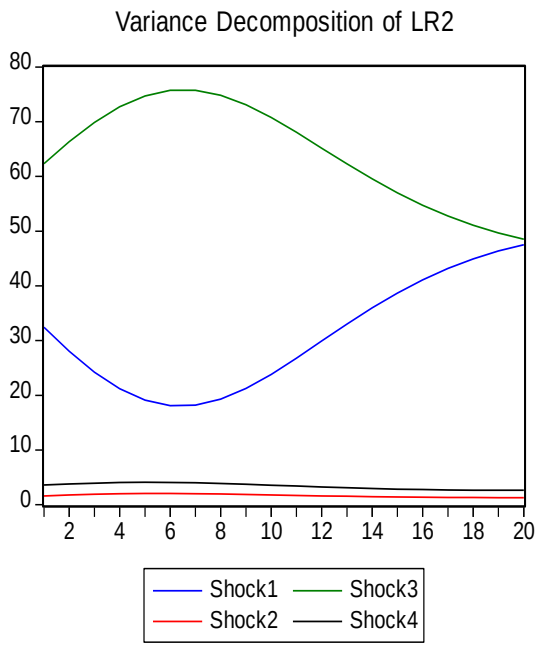


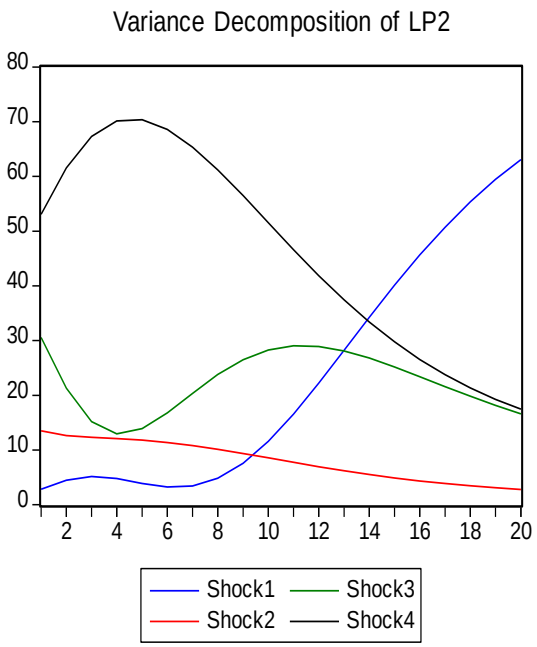


2- KENYA

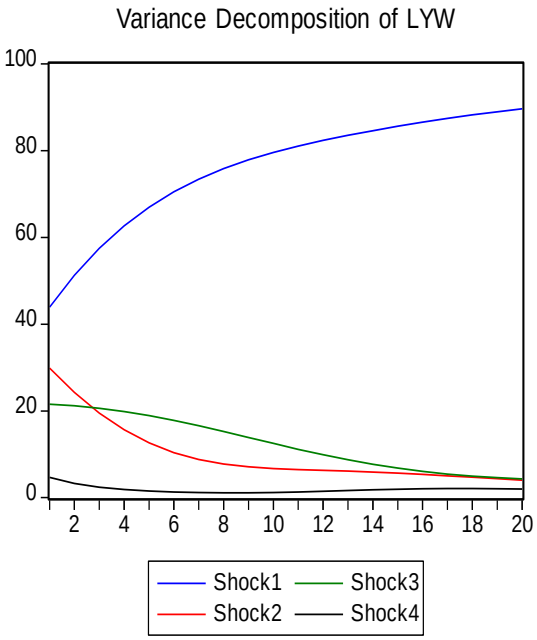

Variance Decomposition of LYW
90
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
Shock1
Shock3
Shock2
Shock4

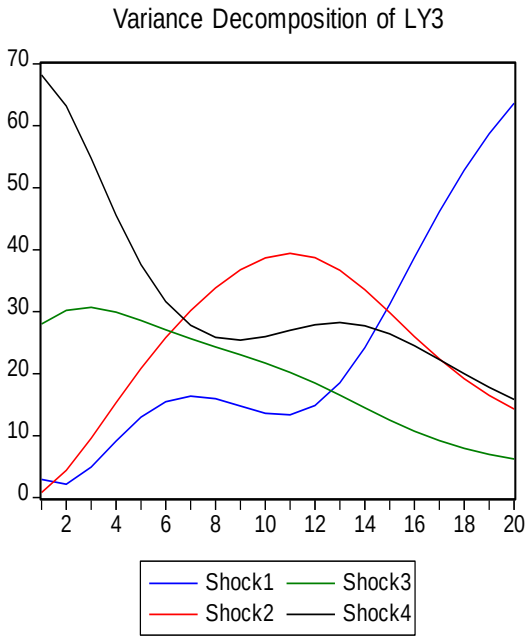

Variance Decomposition of LY2
90
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
Shock1
Shock3
Shock2
Shock4

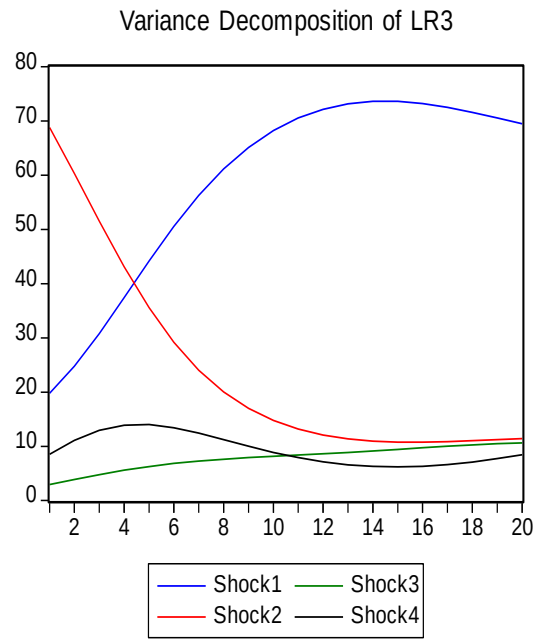

Variance Decomposition of LR2
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
Shock1
Shock3
Shock2
Shock4

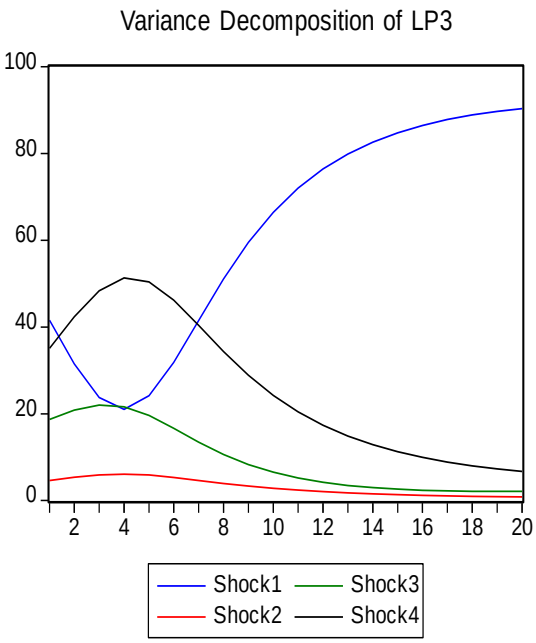

Variance Decomposition of LP2
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
Shock1
Shock3
Shock2
Shock4

3- RWANDA

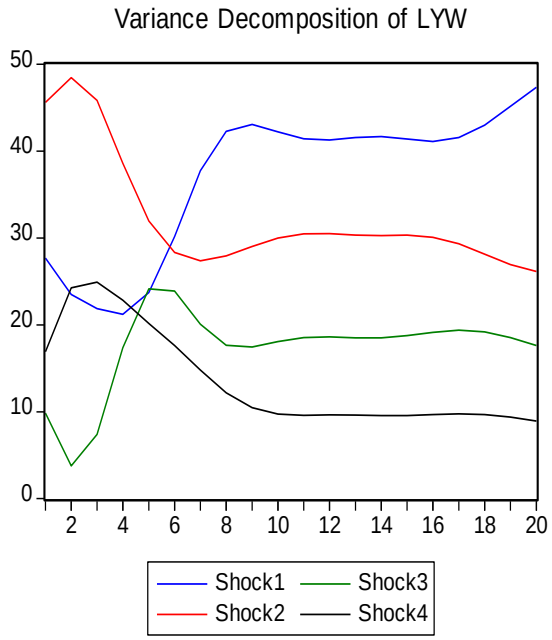

Variance Decomposition of LYW
100
80
60
40
20
0
2 4 6 8 10 12 14 16 18 20
Shock1
Shock2
Shock3
Shock4

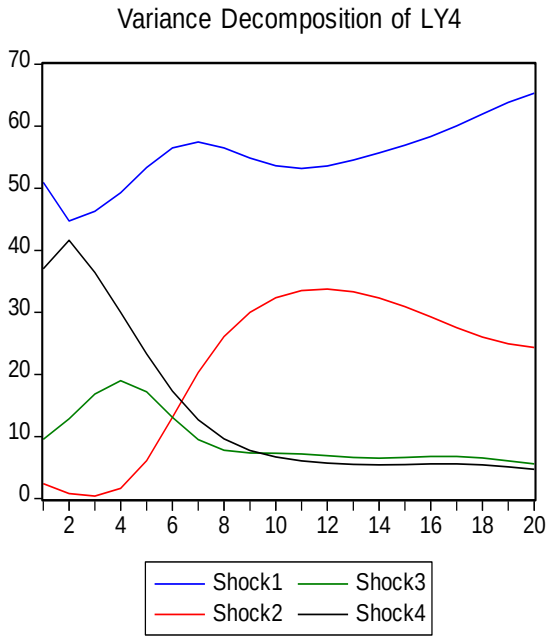

Variance Decomposition of LY3
70
60
50
40
30
20
10
0
2 4 6 8 10 12 14 16 18 20
Shock1
Shock2
Shock3
Shock4

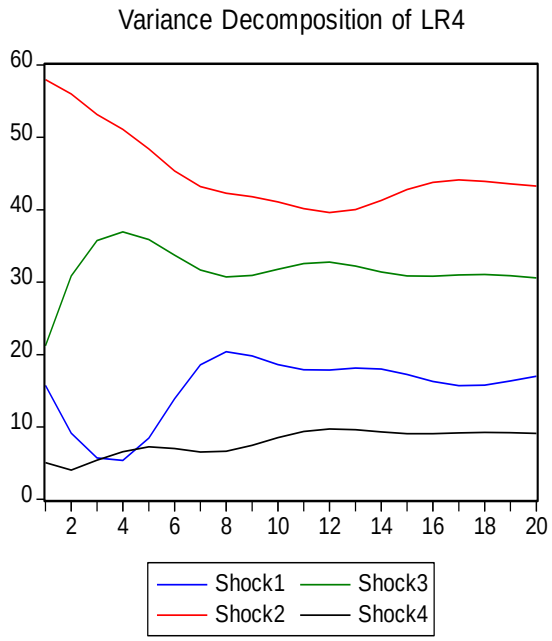

Variance Decomposition of LR3
80
70
60
50
40
30
20
10
0
2 4 6 8 10 12 14 16 18 20
Shock1
Shock2
Shock3
Shock4

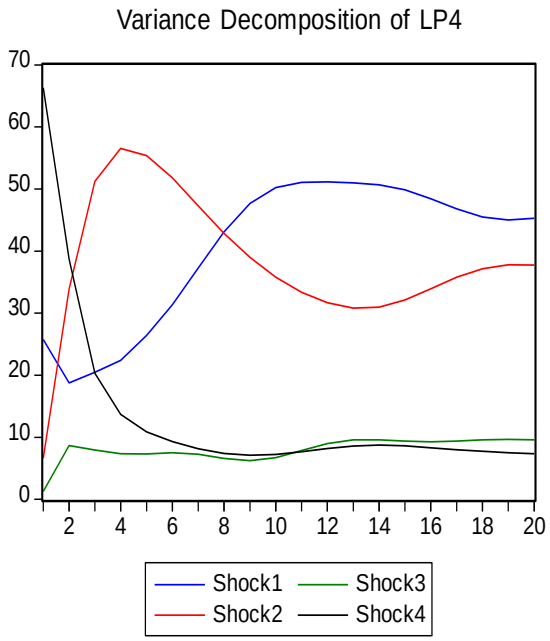

Variance Decomposition of LP3
100
80
60
40
20
0
2 4 6 8 10 12 14 16 18 20
Shock1
Shock2
Shock3
Shock4

4- TANZANIA

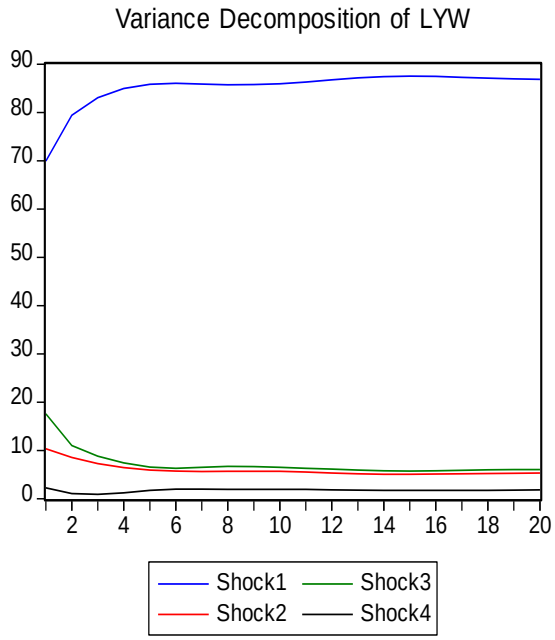

Variance Decomposition of LYW
50
40
30
20
10
0
2 4 6 8 10 12 14 16 18 20
Shock1
Shock2
Shock3
Shock4

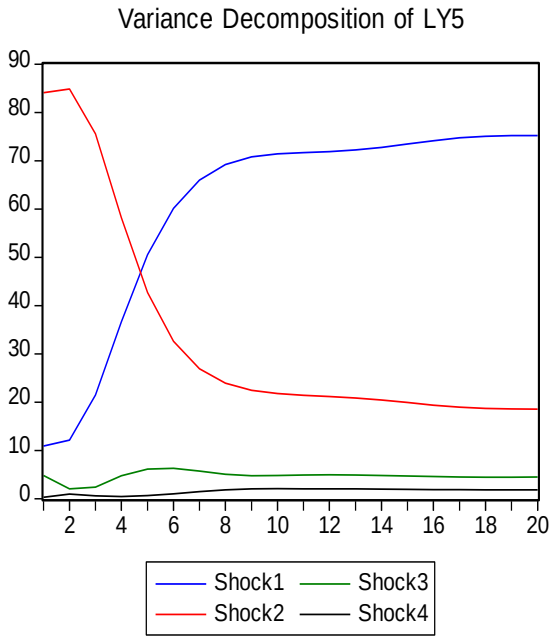

Variance Decomposition of LY4
70
60
50
40
30
20
10
0
2 4 6 8 10 12 14 16 18 20
Shock1
Shock2
Shock3
Shock4

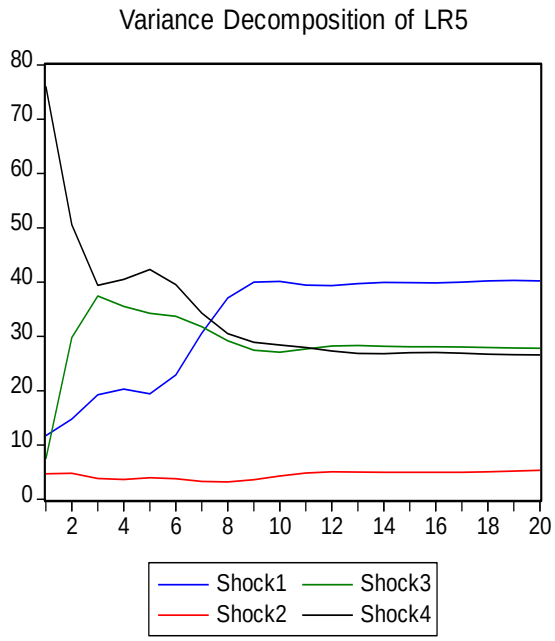

Variance Decomposition of LR4
60
50
40
30
20
10
0
2 4 6 8 10 12 14 16 18 20
Shock1
Shock2
Shock3
Shock4

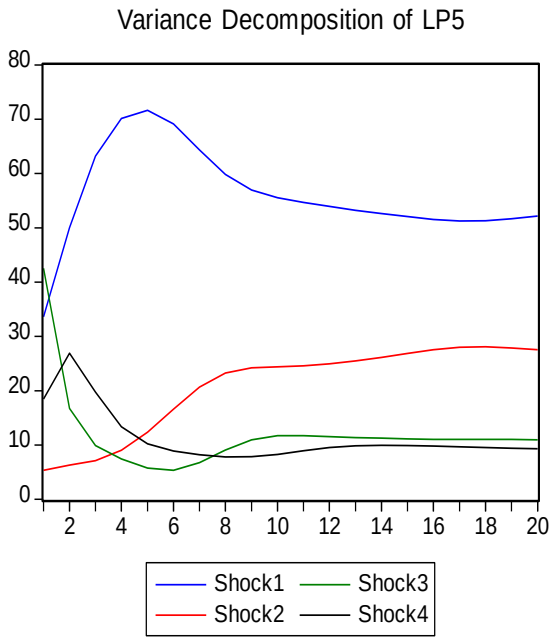

Variance Decomposition of LP4
70
60
50
40
30
20
10
0
2 4 6 8 10 12 14 16 18 20
Shock1
Shock2
Shock3
Shock4

5- UGANDA


Variance Decomposition of LYW
90
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
Shock1
Shock3
Shock2
Shock4


Variance Decomposition of LY5
90
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
Shock1
Shock3
Shock2
Shock4

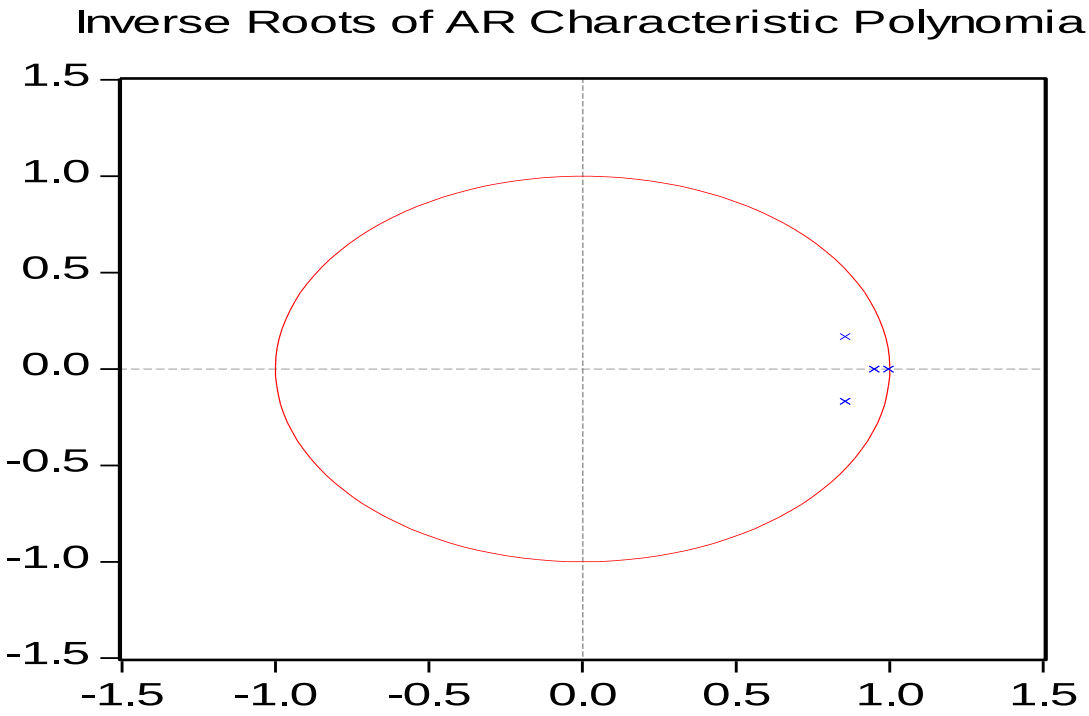

Variance Decomposition of LR5
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
Shock1
Shock3
Shock2
Shock4


Variance Decomposition of LP5
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
Shock1
Shock3
Shock2
Shock4

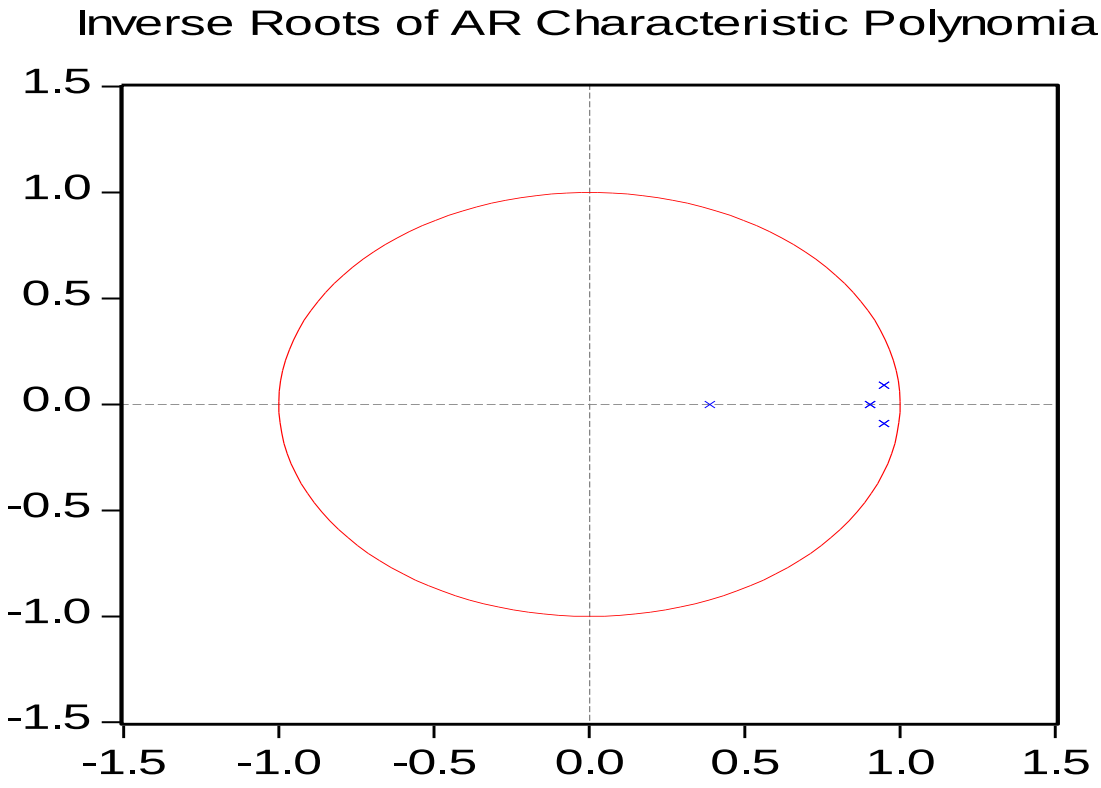
Appendix D

INVERT ROOTS OF AR CHARACTERISTIC POLYNOMIAL

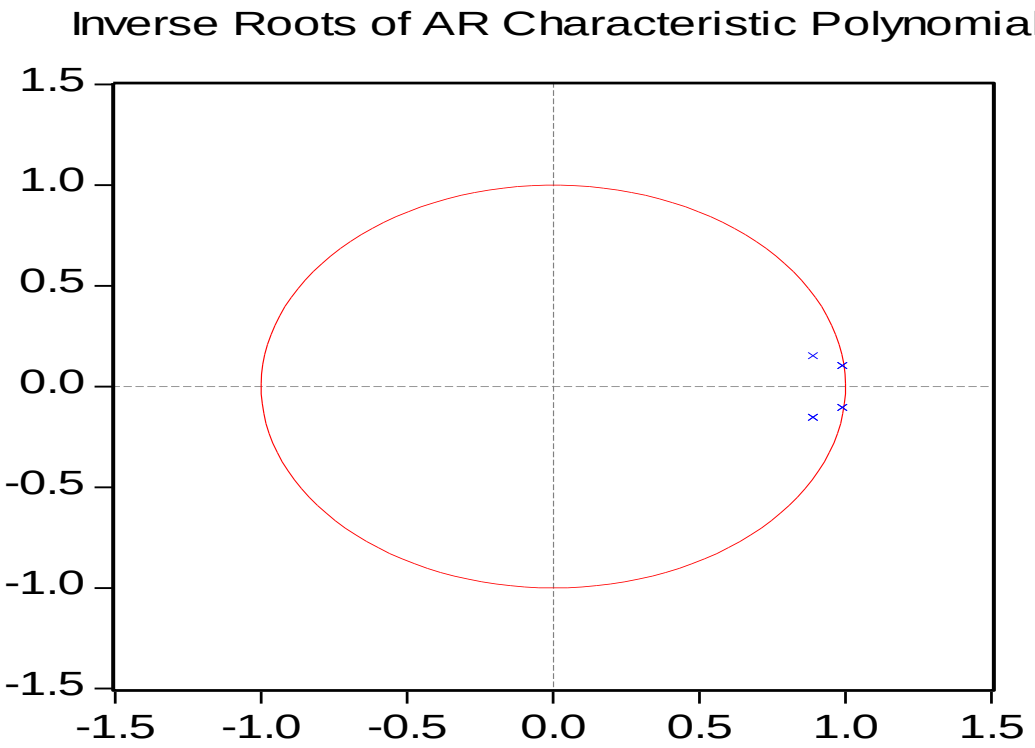
1-Burundi



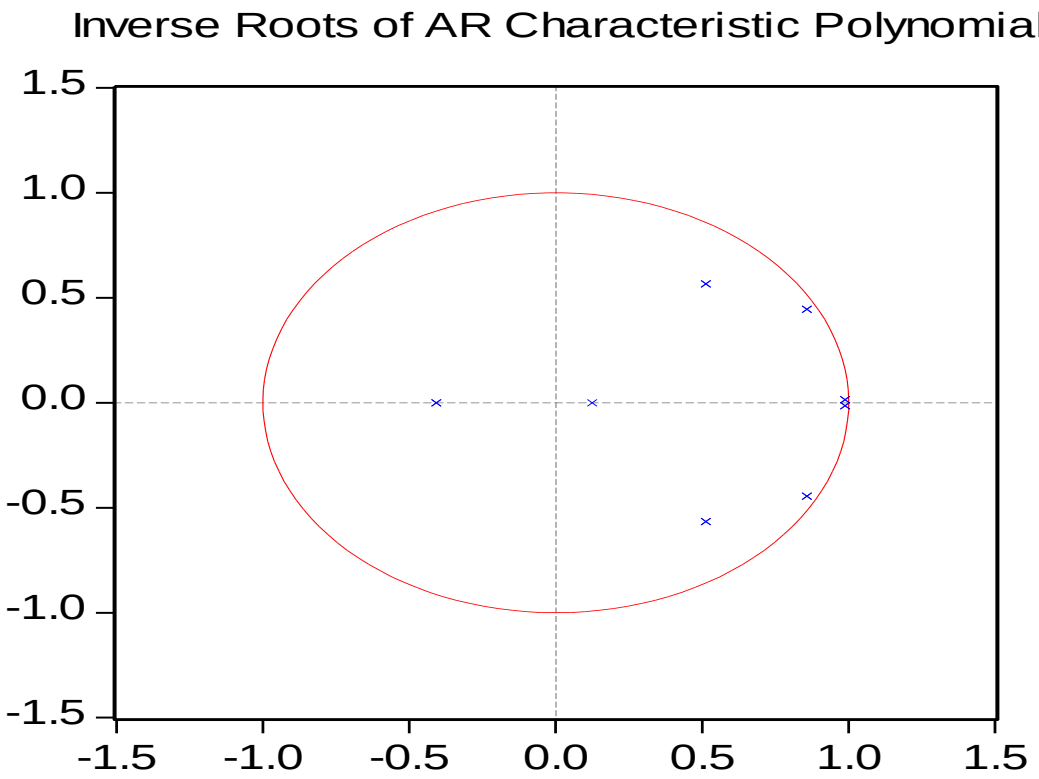
2-Kenya



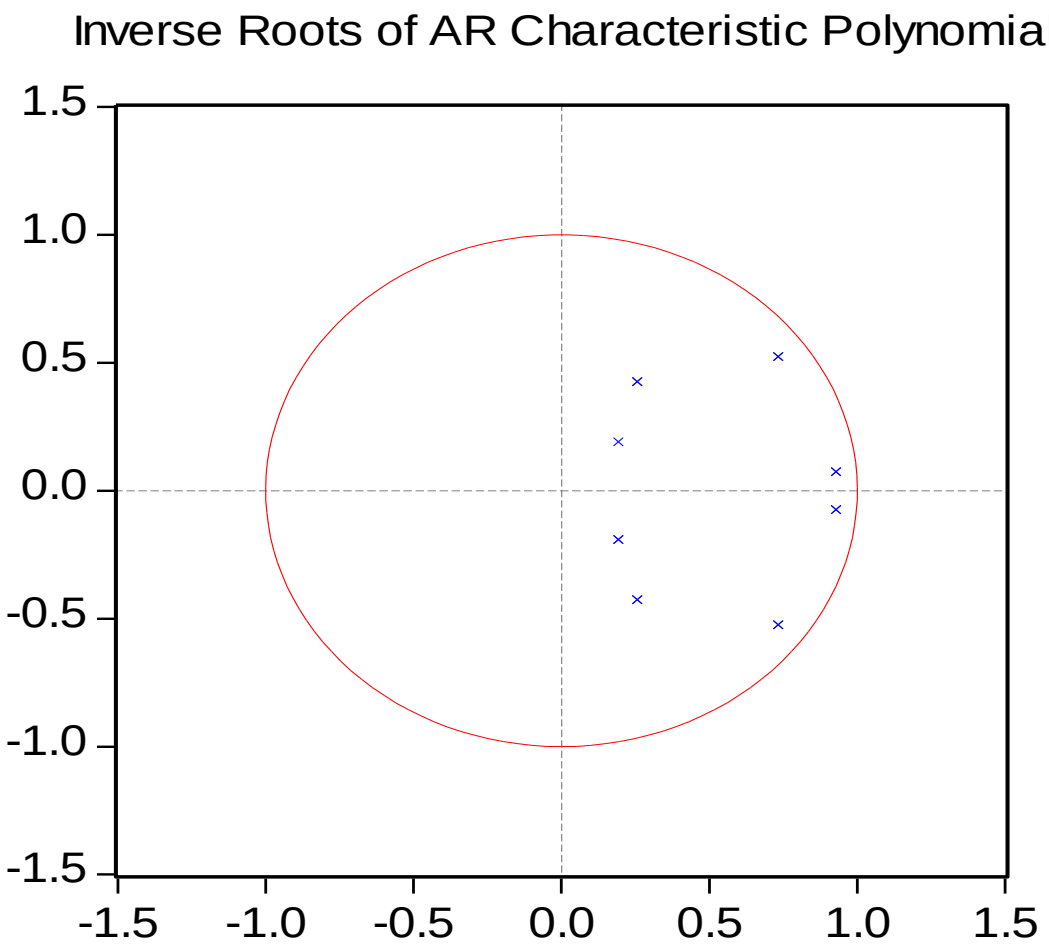
3-Rwanda



4-Tanzania



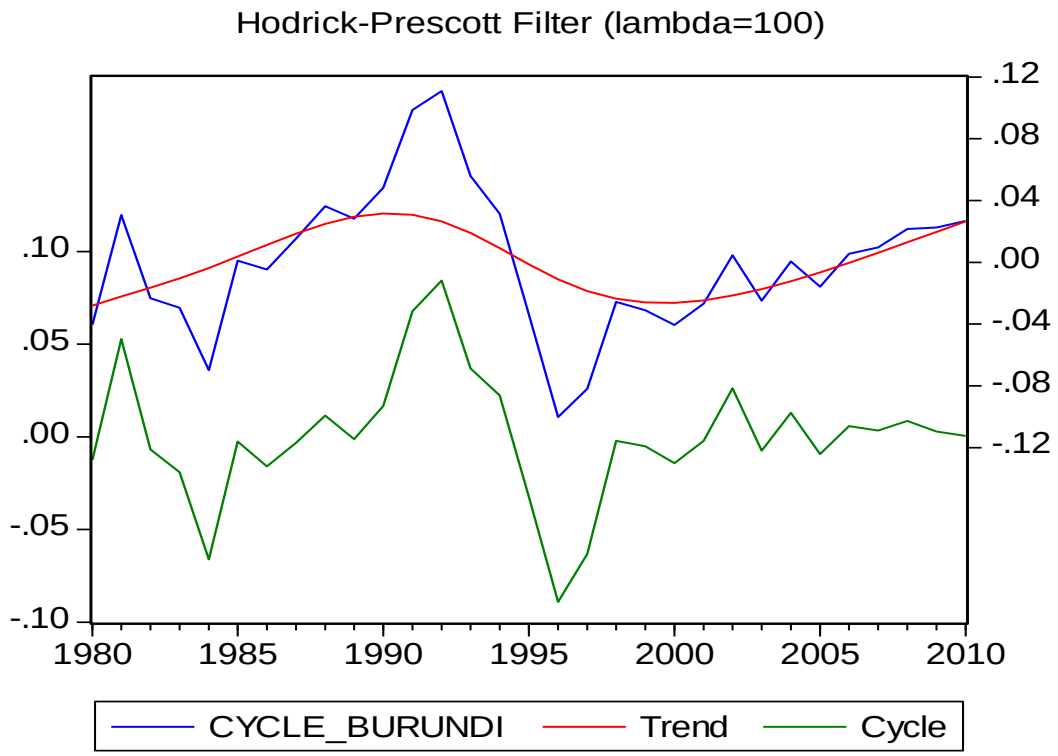
5-Uganda


Inverse Roots of AR Characteristic Polynomial
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5

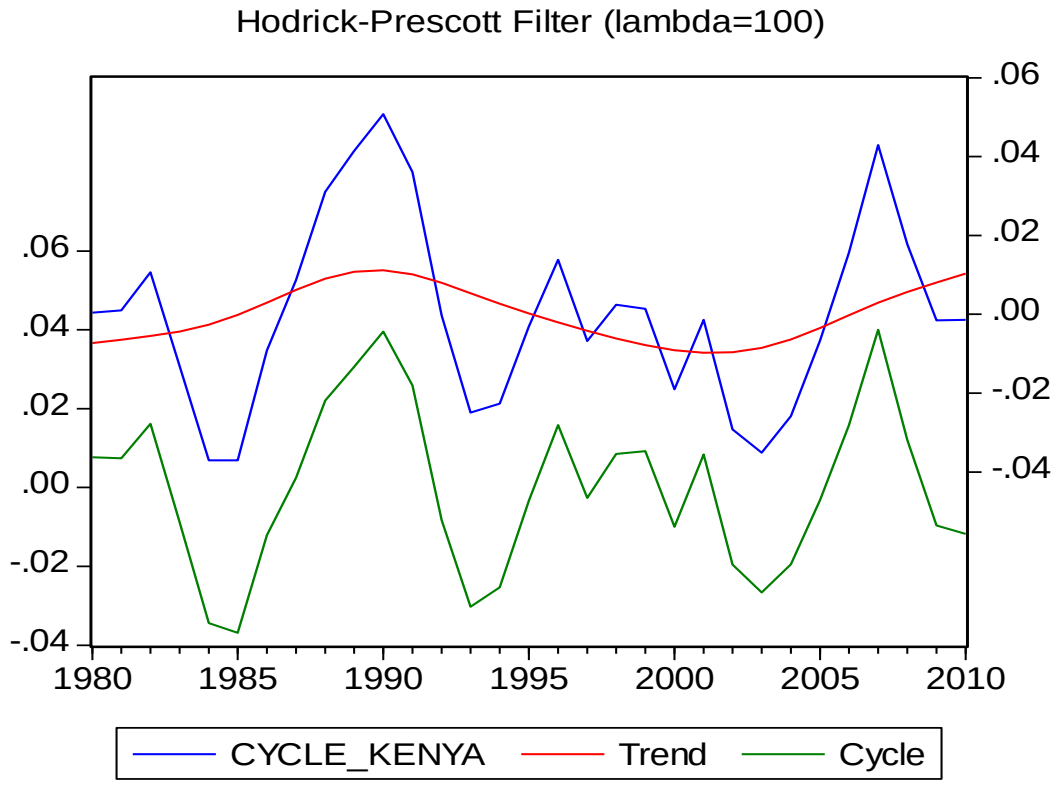
Appendix E

Business Cycle Synchronization HP-Filter

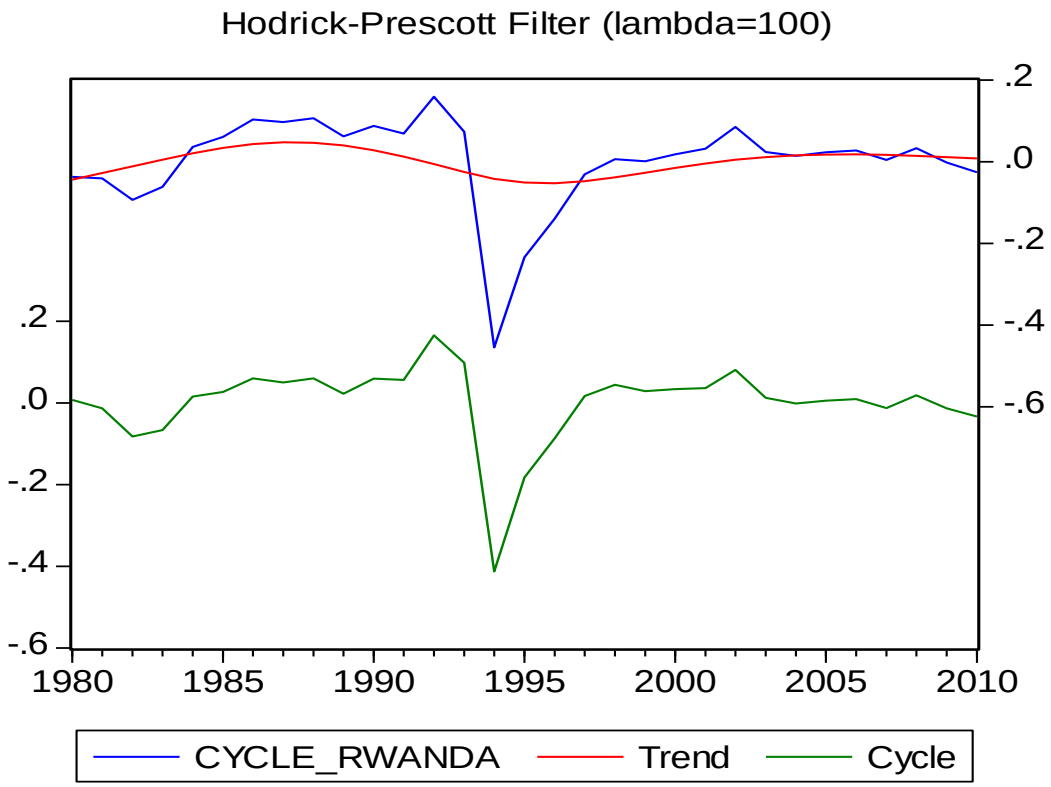
1- Burundi



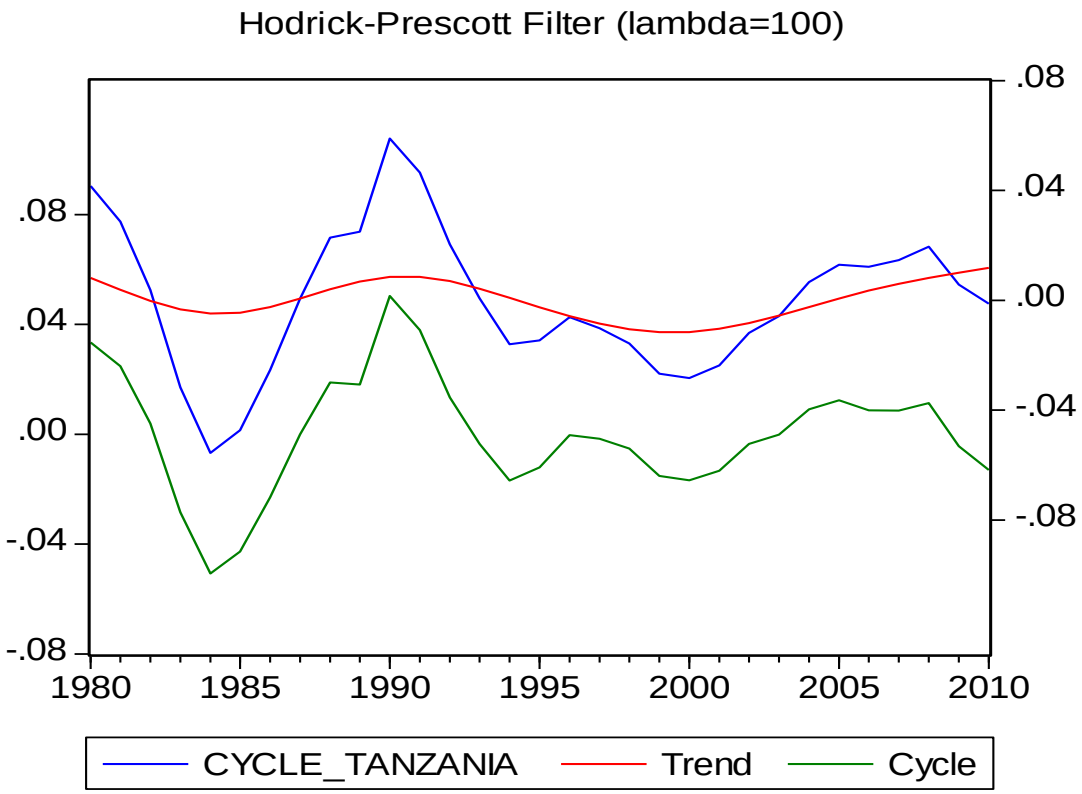
2- Kenya



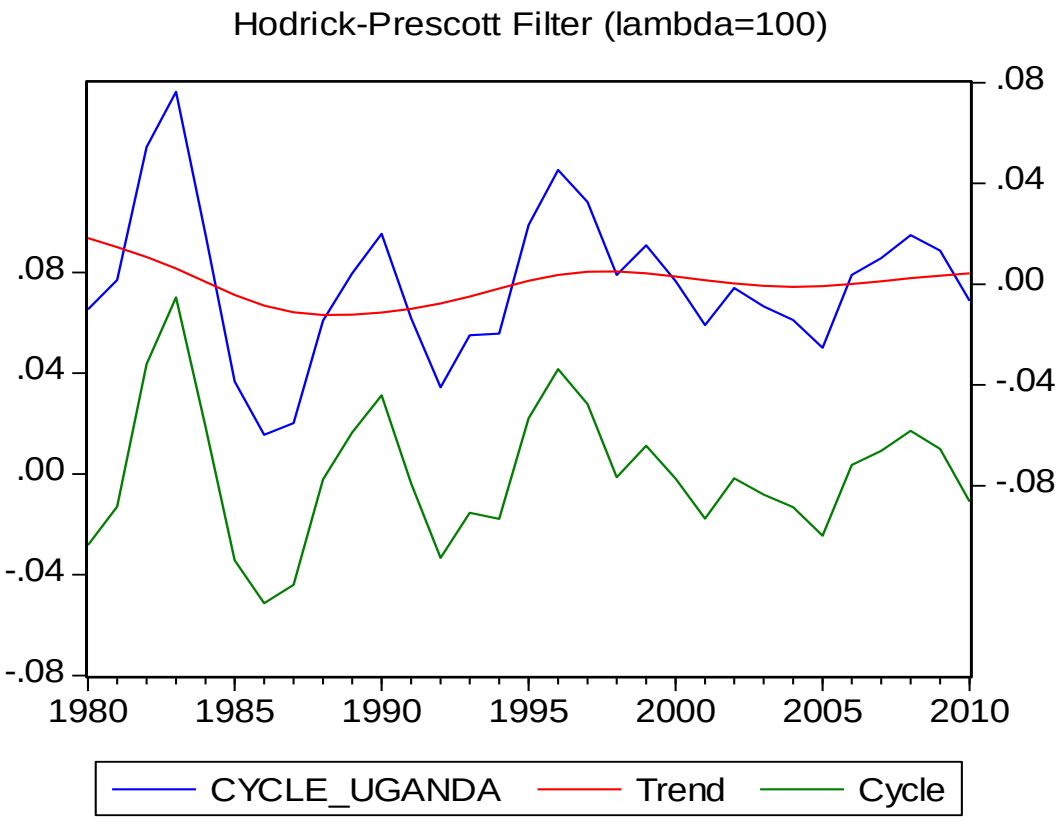
3- Rwanda



4- Tanzania



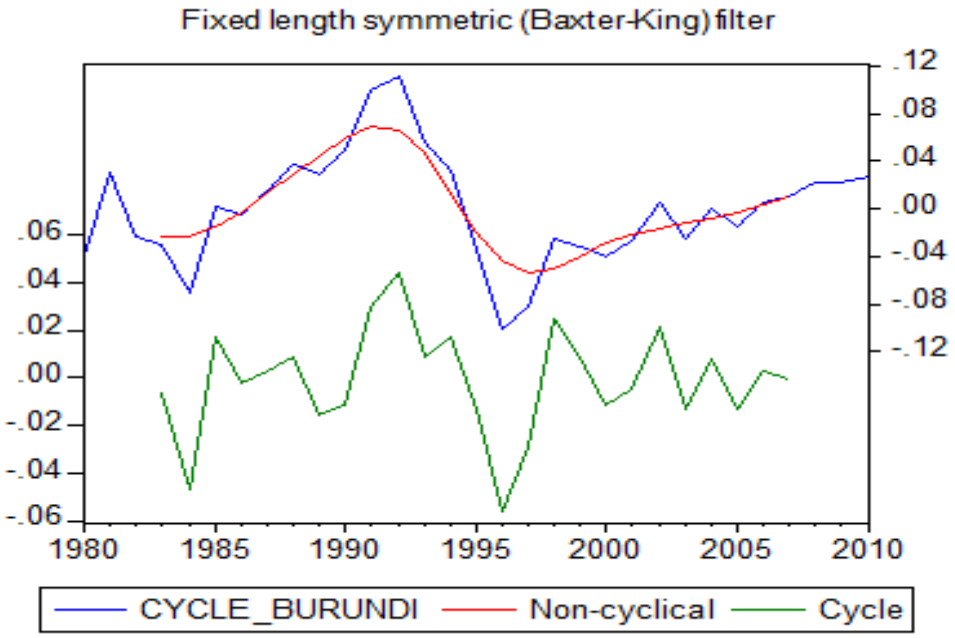
5- Uganda


Hodrick-Prescott Filter (lambda=100)
.08
.04
.00
-.04
-.08
1980
1985
1990
1995
2000
2005
2010
CYCLE_UGANDA
Trend
Cycle

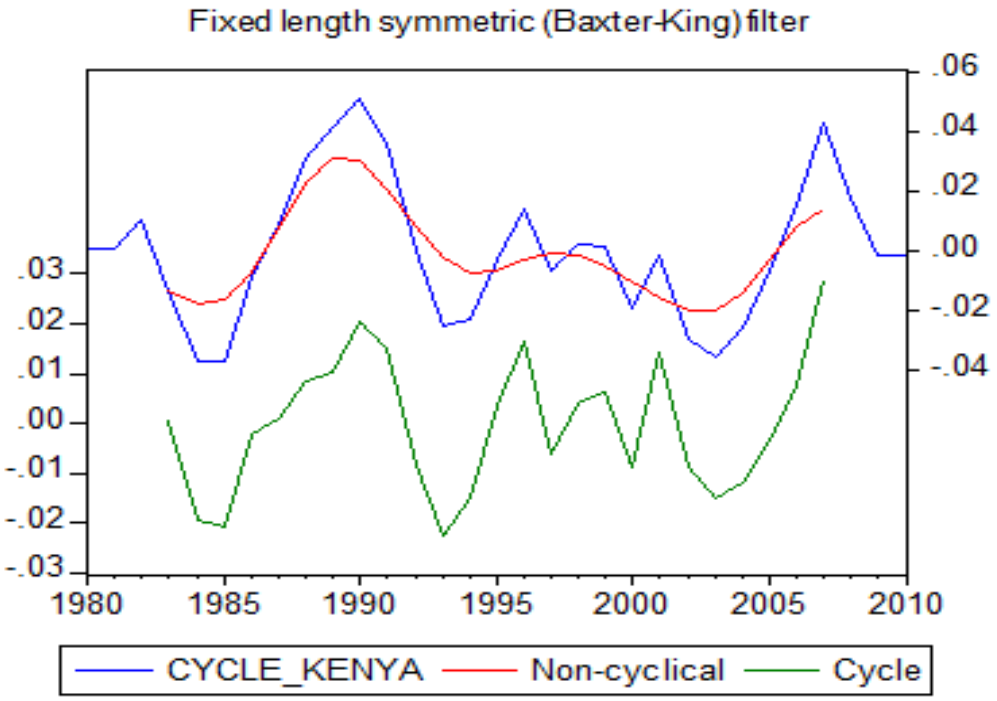
Appendix F

Business Cycle Synchronization BP-Filter

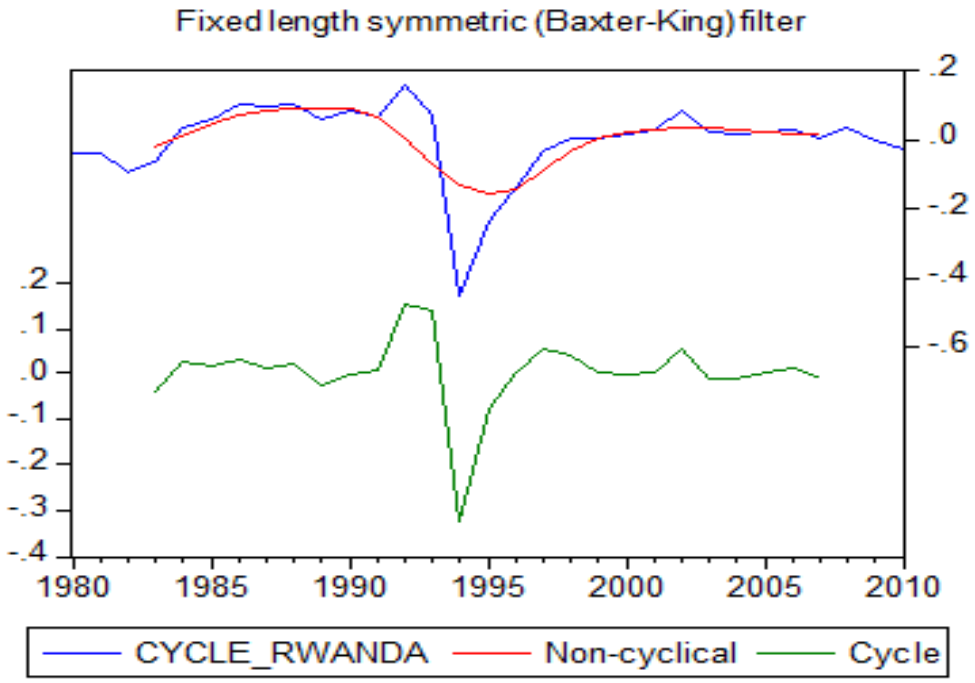
1- Burundi



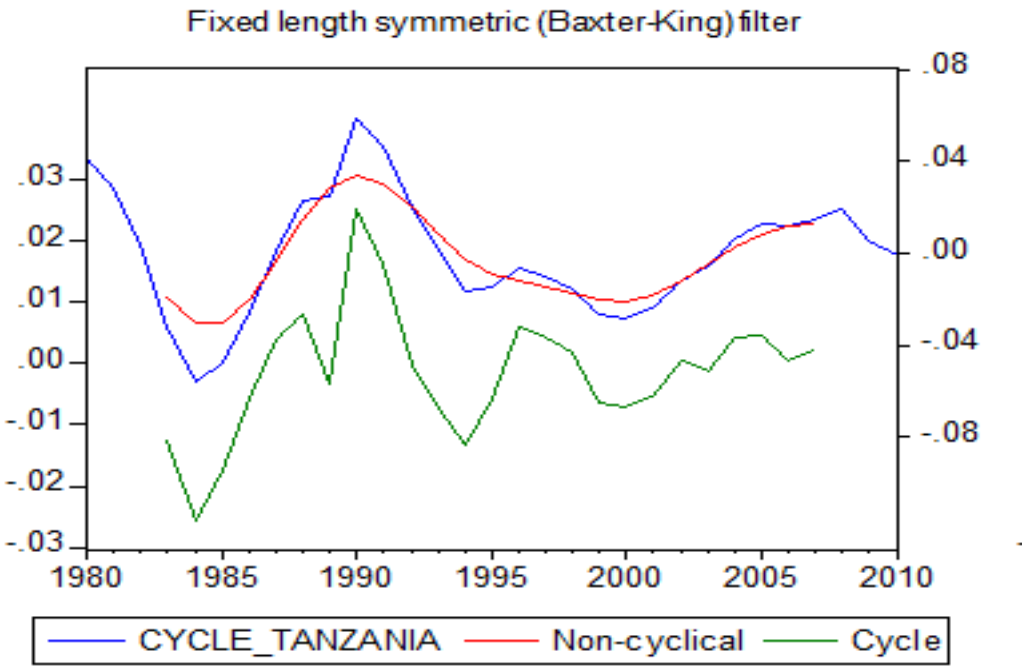
2- Kenya



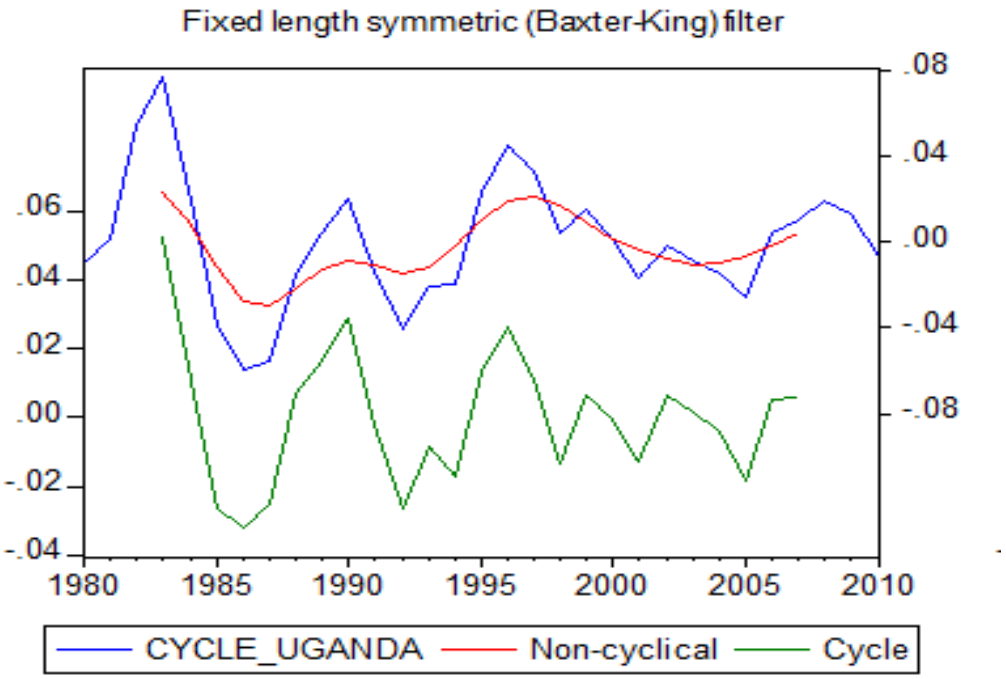
3- Rwanda



4- Tanzania



5- Uganda


Fixed length symmetric (Baxter-King) filter
.08
.04
.00
-.04
-.08
.06
.04
.02
.00
-.02
-.04
1980
1985
1990
1995
2000
2005
2010
CYCLE_UGANDA
Non-cyclical
Cycle

Appendix G

LIST OF PUBLICATIONS

The following papers have been published or submitted from this thesis:

Journal:

- 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.
- Kamaludin Ahmed Sheikh, Zarina Yusuf, and Mohamed Aslam, (2013). "Feasibility of a Monetary Union in the East African Community: A Structural Vector Autoregression Model," Journal of Economics, Business and Management vol. 1, no. 1, pp. 102-105.

Conference

- Kamaludin A. Sheikh, Zarina B. Yusuf, & Mohamed Aslam, (February 24-25, 2013). Feasibility of a Monetary Union in the East African Community: A Structural Vector Autoregression Model., 2nd International Conference on Economics Business and Marketing Management (CEBMM 2013) Rome, Italy.