



**ADDIS ABABA UNIVERSITY**  
**SCHOOL OF GRADUATE STUDIES**

**Does the Exchange Rate Regime Matter for East  
African Countries?**

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**Addis Ababa, Ethiopia**

# **Does the Exchange Rate Regime Matter for East African Countries?**

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**A thesis submitted to the School of Graduate Studies of Addis Ababa University in partial fulfillment of the requirements of Master's of Science Degree in Economics (International Economics)**

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## Abstract

This study aimed at identifying whether the choice of exchange rate regime (ERR) matter for the inflation and economic growth of East African countries and identifying which regimes do best for the region. To do so it used the panel data of 10(ten) selected countries observed from 1996-2016. It used descriptive statistics and econometric analysis techniques.

Even though the de-jure regime was much smaller than the de-facto, the study found that intermediate regimes dominated other ERRs. Relatively the highest levels of inflation are recorded in Malawi and Zambia while Uganda had the lowest inflation. The analysis also shows that the highest average growth level was that of Mozambique and the lowest was that of Burundi.

The study found that both the claim and practice of intermediate regimes are related to lower inflation compared to pegged regimes. In the 'coarse' classification crawling regimes are negatively related to inflation compared to pegged regimes. Moreover, estimation of the 'fine' classification shows de-facto crawling peg and crawling band are negatively related to inflation compared to currency board arrangement. The study also found that de-facto intermediate regimes are negatively related to economic growth. When the 'coarse' classification of regimes is applied all intermediate regimes (i.e. crawling, managed floating and free falling regimes) are negatively related to growth. However, when institutional quality is controlled almost all the regime dummies of the 'fine' classification became insignificant in the growth regression. The result implies that the choice of ERR should be based on whether countries target either inflation or growth. Future researchers could focus on "why countries choose regimes?".

**Key words:** Exchange rate regime, Economic growth, Inflation, World governance indicator, 'fine' classification, 'coarse' classification, de-facto, de-jure.

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## List of Acronyms

|         |                                                                 |
|---------|-----------------------------------------------------------------|
| AREAER  | Annual Report on Exchange Arrangements and Exchange Restriction |
| CBI     | Central Bank Independence                                       |
| CFA     | Communaute´ Financie`re Africaine                               |
| CPI     | Consumer Price Index                                            |
| DC      | Developed Countries                                             |
| EC      | European Commission                                             |
| ERM     | Exchange Rate Mechanism                                         |
| ERR     | Exchange Rate Regime                                            |
| FE      | Fixed Effect                                                    |
| FPM     | Flexible Price Monetary Model                                   |
| GDP     | Gross Domestic Product                                          |
| GMM     | Generalized Method of Moments                                   |
| Ibid    | In the same place                                               |
| ICRG    | International Country Risk Guide                                |
| IMF     | International Monetary Fund                                     |
| IS      | Investment-Saving (goods market equilibrium)                    |
| LDC     | Less Developed Countries                                        |
| LM      | Liquidity-Money Supply (Money market Equilibrium)               |
| OLS     | Ordinary List Square                                            |
| PBM     | Portfolio Balance Model                                         |
| RE      | Random Effect                                                   |
| REH     | Rational Expectation Hypothesis                                 |
| RGDP    | Real Gross Domestic Product                                     |
| SD      | Standard Deviation                                              |
| SPMM    | Sticky Price Monetary Model                                     |
| SYS-GMM | System Generalized method of Moments                            |
| TOT     | Term of Trade                                                   |
| UN      | United Nations                                                  |
| US      | United States                                                   |
| WB      | World Bank                                                      |
| WDI     | World Development Indicators                                    |
| WEO     | World Economic Outlook                                          |
| WGI     | World Governance Indicator                                      |
| WWI     | World War First                                                 |

# CHAPTER 1: INTRODUCTION

## 1.1 Background of the study

The concept of exchange rate regime (ERR) is related to the beginning of using currency (fiat money) as a medium of exchange. Because before that goods and services were exchanged for other goods and services or precious metals where their value varies based on the rules of demand and supply (Macleod, 2012).

After the introduction of currency, mainly after 1821 when England introduced the Fiat money perfectly convertible to Gold the world followed different exchange rate regimes. According to Johnson (1969), the history of exchange rate regimes until 1973 (the failure of Britton Woods system) was mainly dominated by the gold standard in one or another way with some exceptions like the interwar period. He argued the exchange rate regime in the interwar period was managed floating regime.

The history of ERR after 1973 was different for developing and developed countries (LDCs and DCs respectively). The developed countries followed floating ERR (especially until 1980), and some form of the pegged exchange rate with horizontal bands (until the early 21st century for Euro members) and later on at the early 21st century, the European Commission (EC) introduced the Euro which still prevails with 21 members. On the other hand, Developing countries followed the Pegged (adjustable or otherwise) ERR mainly until the Asian crisis of the early 1990s; after which many developing countries began using diversified exchange rate regimes(Macleod, 2012).

According to Encyclopedia Britannica East Africa comprises of Mountainous region (the horn of Africa) and coastal region ranging from Kenya to South Africa. It consists of the two tallest mountains in the continent and the Great Rift-Valley. It also consist the second largest and deepest lakes in the world, Lake Victoria and Lake Tanganyika, respectively. It is also home for the Ancient civilizations like Aksum and Meroe (Keet, 2013).

History of ERR of East African countries mostly was the same with their colonizers (Pegged regime) while Ethiopia used the fixed ERR during the Bretton woods era. Even after the end of the Bretton Woods system in 1973 the pegged regime continued in most of the countries by

changing the anchor from dollar to IMF's SDR. However, by 1985 & 86 the choice of ERR in the region started diversifying as countries like Burundi, Tanzania and Uganda adopted the floating regime. Nevertheless, the adoption of floating regime short lived in most of the countries as the floating itself was the result of balance of payment crisis and highly overvalued exchange rates. Towards the end of the old century and beginning of the new century the regimes in the region were diversified enough to include different types of intermediate regimes (like, crawling regimes and managed floating regimes) in addition to the two extreme regimes (Simwaka, 2010).

## **1.2 Statement of the problem**

Different researches done on the impact of ERR on economic growth are among the kinds of literature showing contradicting results. According to Bohl, Michaelis and Siklos (2016) all types of ERR can promote economic growth when panel of countries of all types were studied, but if countries are disaggregated into groups Pegged regimes work best for emerging countries while crawling regimes work best for G-20 countries. Bohl et al (2016) finding is supported by Rivero & Ramos-Herreradiffer (2014), Lartey (2017), Aghion, Bacchetta, Ranciere and Rogoff (2009) and Rodriguez (2017).

A study by Aghion et al (2009) reported that the level of financial development matters, but he stated that excess exchange rate flexibility negatively affects economic growth. However, according to Rivero & Ramos-Herreradiffer (2014), it is the level of income which matters (not the level of financial development). It stated that growth is best under intermediate regimes and worst under flexible regimes.

Gosh (2014) found pegged regimes are associated with slower economic growth for both High and low-income countries while intermediate regimes are insignificant for economic growth. The finding of Gosh completely disagrees with Bohl et al. (2016) However, both Gosh and Bohl et al. more or less agree on the importance of a fixed regime for the growth of emerging countries (mainly Asia). The finding of Gosh (2014) somehow agrees with Levy-Yeyati & Sturzenegger (LYS) (2003) in the conclusion that fixed regimes are associated with slower growth but it somehow disagree with it in the finding that the association works for both advanced and LDCs since LYS (2003) found no association of ERR with growth for DCs.

In general, it can be said that Josheski, Ljubica and Cane (2011), Rodriguez (2017), Aghion et al (2009), Vieira (2013), Janus and Riera-Crichton(2015) reported that exchange rate flexibility is negatively associated with growth and fixed ERR is positively associated with growth. On the other hand, Broda (2002), Lartey (2017) and Lorna et al (2016) reported the opposite, while, Rivero & Ramos-Herreradiffer (2014) and Petreski (2014) reported intermediate regimes best promote economic growth.

Studies done on the effect of ERR on inflation, also displays more or less the same contradicting result. According to Zhao et al (2014) countries with flexible ERR has high inflation and high domestic credit which makes them vulnerable to a currency crisis. A study by D'Adamo & Rovelli (2015) contradicts with this finding because it states that for emerging countries their early shift to a pegged regime results in high inflation.

Studies by Sissoko and Dibooglu (2005) Bleaney and Francisco (2005) confirm the earlier finding that Pegged (Fixed) ERRs are good for controlling inflation. However, Husain, Mody, and Rogoff (2005) found no evidence that inflation rates differ with the difference in the ERR in advanced countries. Jackson & Miles (2008) confirmed the Husain et al (2008) result for LDCs.

Finally, all the above papers seem to at least partially disagree with LYS (2001), since LYS found hard pegs stabilize inflation better at the cost of economic growth while short pegs (pegs lasting less than 5 years) to underperform floats in both inflation and growth.

As it can be understood from the above review the topic of the choice of ERR is one of the most widely researched topics in economics. However, the results are far from being conclusive, showing that there is no simple answer to the question "does the exchange rate regime matter for economic performance?" and the answer varies over time, across a group of countries studied, across different methodologies (model specification and method of analysis) and the way the issue is studied and results interpreted. Moreover, as the study will show in the next chapter the theories are also very much conflicting.

The study also looked at the actual data of some sample East African countries, namely, Ethiopia, Kenya and Uganda and compared it with de facto ERR classification of Ilzetzi, Reinhart and Rogoff (2017) if it could give some information about the importance of choice of ERR for economic performance. According to the Fine classification of Ilzetzi et al from 1996 onwards Ethiopia has been having a de facto crawling peg regime with the exception of 1996.

Kenya had de-facto crawling band less than or equal to 2 from 1996-2016. Uganda had de-facto crawling band less than or equal to 5. On the other hand, in de jure terms both Kenya and Uganda claim a floating ERR while Ethiopia claim managed floating regime.

The growth performance (RGDP) of the countries looks like favoring the de-facto crawling peg regime because; even if, it shows higher volatility the RGDP of Ethiopia show more increasing value (growth rate (8.26%)) and trend relative to Kenya (4.08%) and Uganda (6.41%). The growth performance of Uganda shows more or less the same trend like Kenya but decreasing RGDP growth rate. Therefore, even if it is too early to conclude the performance of the countries seem to rank crawling peg, first; crawling band less than or equal to 2, second and; crawling with a wider band as the third choice to promote economic growth. If comparison is made based on words (de-jure regimes) it might mean a declaration of intermediate regime work better for economic growth than floating regimes.

Another indicator of macroeconomic performance is inflation. Inflation (measured by Consumer price index (CPI)) in Kenya and Uganda was relatively stable (SD of 75.75 and 38.18) compared Ethiopia (SD 193.41). The case of Ethiopia, unlike its neighboring countries, was rising especially after the year of devaluation (2008). This might imply that the free-falling regime (huge devaluation) could be associated with inflation. Moreover, it might also mean a crawling peg regime could not stabilize inflation. Finally, it can also be said that the choice of exchange rate policies for inflation stabilization is the inverse of choice of ERR policies for economic growth because in addition to the case of Ethiopia the data shows higher inflation in Kenya (165.9) (narrower crawling band regime) than Uganda (87.29). (Appendix 5,6 & 8)

The above simple descriptive analysis at least partially contradicts with all previous studies. However, it partially agrees with the finding of Laverde-Molina (2016) who found inflation in Costa-Rica is higher under crawling peg regime.

It is obvious in economics that there may not be a general consensus on an issue. But often when there is theoretical disagreement, empirical evidence plays a particularly important role. But in this topic, empirical studies face multiple difficulties, mostly associated with the fact that countries (fortunately) do not choose their regimes in a random fashion. In many instances they do not really choose their regimes at all, but rather find them imposed by economic

circumstances; more often than not, de jure and de facto regimes are different; and for some regimes, very few observations can be or have been made (Caputo and Magendzo, 2011).

Moreover, according to LYS (2001), there are surprisingly fewer researches compared to other internationally important other topics. The study agrees with them especially when we come to Africa there are limited empirical references directly dealing with the ERR effect on economic performance. Even if there are some studies most of them are based on CFA Vs non-CFA groupings, which officially ceased following the adoption of the Euro in 2002.

On the other hand, there is no specific study on the importance of the choice of ERR on the economic performance of East African countries in particular. It is very important to deal with the issue with respect to the region because of different reasons. First, studies done in different parts of the world show different results. Second, most countries in the region are relatively poor with poor financial development. Third, most countries in the region have no access to the international financial market whose preference is mostly explained as a reason for the preference of one regime over the other for different countries. Therefore, the purpose of this study is to analyze both the theoretical and empirical studies on the topic and prove and disprove the result of different studies using a different sample for East Africa.

### **1.3 Research Questions**

Generally, the study mainly aims at finding answers to the following questions.

- I. Does the exchange rate regime matter for economic growth (RGDP per capita growth) of East African countries? If so, which regimes promote (demote) economic growth?
- II. Does the ERR matter for inflation (CPI)? If so, which regimes help control inflation?
- III. What are the other determinants of Inflation and RGDP?

### **1.4 Objective of the study**

The objective of this study is to investigate the importance of choice of exchange rate regime for East African countries economic performance. The study answers the question of whether the choice of exchange rate regimes matters for macroeconomic performance by taking some of the macroeconomic performance indicators. Specifically, the study has had the following objectives:

- I. Analyze the relationship between ERR choice and economic growth

- II. Analyze the relationship between ERR choice and Inflation

## **1.5 Hypothesis of the study**

Even though the previous studies on wider or different sample show conflicting results, there is no any previous study made specifically on East Africa. Therefore, the researcher made the following hypothesis, on the basis of the available theoretical and empirical works done on wider or different sample.

- I. Fixed (Pegged) ERR is expected to negatively affect both Inflation and economic growth compared to a floating regime.
- II. Intermediate regimes are expected to increase inflation more than both fixed and flexible regimes with no significant impact on economic growth.
- III. Floating ERR is expected to positively affect economic growth with no significant impact on inflation.
- IV. Among the control variables in our inflation model growth of broad money, RGDP growth and term of trade shock (growth) are expected to be positively associated with inflation. On the other hand, control variables like Central bank independence, openness, and positive fiscal balance are expected to be negatively associated with inflation
- V. In the case of growth model control variables like initial GDP per capita, school life expectancy, terms of trade, investment, fiscal balance and trade openness are expected to have a positive impact on economic growth. The other control variables of the growth model i.e. population growth, real exchange rate; inflation and government expenditure (GDP percentage) are expected to negatively correlate with economic growth.
- VI. Finally, institutional quality is expected to positively affect economic growth, while affecting inflation negatively.

## **1.6 Significance and Scope of the study**

The scope of the study is limited to East African countries using the data ranging from 1996-2016. The study is limited to analyzing the choice of ERR choice only for macroeconomic performance excluding the impact on microeconomic performance and for political reasons.

The study will help future studies by providing some summarized benchmarks to a more detailed study as there are no previous studies on the topic specific to the study are. The study will also provide some insight for policymakers in the region on the choice of ERR.

## **1.7 Organization of the Thesis**

The rest of the thesis is organized as follows. The next chapter will present a comprehensive review of selected theoretical and empirical literature on the topic. The third chapter presents an explanation of the types of data, their source, a method of the data analysis, the models used and all related information's. The fourth chapter which is the most important chapter of the thesis presents both the descriptive and econometric analysis of the data. The last chapter presents the conclusions drawn from the analysis and recommendations for different stack holders.

## CHAPTER II: REVIEW OF THEORETICAL LITERATURE AND EMPIRICAL EVIDENCE

In this chapter, the paper discusses the following topics divided into four sections. The first section which presents theoretical issues on the exchange rate regime (ERR) is presented in five sub-sections. The first sub-section is about defining the concept of exchange rate and exchange rate regime. Then the second sub-section is about the history of ERR choices. The third subsection is about the classification of ERR. The fourth and fifth sub-sections are about the theoretical arguments of ERR and theories of exchange rate determination respectively

The second section of the chapter presents empirical evidence on the exchange rate regime divided into four sub-sections. The section first present empirical evidence on the relationship between the ERR and economic growth. Then it is followed by the second sub-section presenting empirical evidence on the relationship between ERR and inflation. The third sub-section is about the evidence on the correlation between ERR and capital mobility. Finally, the section is concluded by the subsection presenting the relation between ERR and the likelihood of an economic crisis.

The third section of this chapter is about the evaluation of the theoretical literature in the context of this research. Finally, the fourth section will present the conceptual framework.

### 2.1 Review of Theoretical Literature

#### 2.1.1 Definition of terms related to exchange rate and exchange rate regime

**Exchange rate:** is the price of one currency in terms of another currency. Example 'How many Ethiopian birr's can buy a US dollar?'. Exchange rate allows us to denominate the cost or price of a good or service in a common currency. It also allows us to compare the prices of goods and services produced in different countries (Rutherford, 2002).

**Exchange rate regime:** It is the system in which country's adopt its own exchange rate against other currencies (<http://policonomics.com>). It is the method used by a government to manage the relative value of its currency with respect to other currencies. A country might implement an exchange rate regime for its national currency in order

to manipulate the way that its currency is valued in the foreign exchange market ([www.investorguide.com](http://www.investorguide.com)).

**De-jure exchange rate regime:** It can be defined as what a country's government 'claims' to do in relation to the exchange rate system. It is the officially declared exchange rate arrangement that a country follows. The de jure exchange rate regimes are important because what the central bank communicates to the public is likely to have its own impact on the country's performances ([www.mbaknol.com](http://www.mbaknol.com)).

**De-facto exchange rate regime:** The de facto exchange rate regime can be defined as what countries actually do in regard to their exchange rate system despite what they claim ([www.mbaknol.com](http://www.mbaknol.com)).

### 2.1.2 History of exchange rate regimes

The question of which ERR to follow can be traced back to the nineteenth century, particularly 1821 where the central bank of England declared a gold standard system where the pound is perfectly convertible to gold (Fixed exchange rate regime, where the value of currency varies only with the variation in the value of gold) (Macleod, 2012).

According to Bordo (2003), the gold standard has evolved by 1880 from the bimetallic standards. According to this study, the evolution was due to several factors like; the Franco-Prussian war, massive silver discoveries attempts to follow Great Britain (which already had de-facto gold standard), network externalities and technology of coinage.

In the pre-1914 period, there were also a number of monetary unions and currency boards. Two types of monetary unions prevailed: international unions such as the Latin monetary union and the Scandinavian monetary union, which basically involved arrangements for standardizing gold and silver coins and the clearing of payments; and national monetary unions, such as the United States, Germany and Italy, which involved the complete economic and political integration of the member states with a common currency (Bordo and Jonung 2000) as cited in (Bordo, 2003). According to Broda (2003), many countries switched from silver and bimetallic standards to a gold standard system by 1900.

Regarding the era of WWI from 1915 to 1925 there is disagreement between proponents of fixed ERR and flexible ERRs where supporters of fixed ERR say it is a period of flexible ERR the

flexible regime block argues it is not flexible regime rather managed floating regime following the disorder of national policies following the failure of the fixed regime (Johnson, 1969).

The period from 1926 to 1931 had been referred as gold standard system following the Genoa conference in 1922. In this period all European currencies were convertible into Pound and Pound to Dollar and Dollar to Gold (Macleod, 2012). This system is also collapsed after Britain failed to keep the standard following the Mutiny of its Royal Navy (Ibid, 2012 and Broda 2003).

Then Britain's decision being followed by other European governments and following the declaration of Roosevelt administration of United States (US) to suspend the convertibility of Dollar into gold for local holders because of the great depression, the period of Floating regime followed (it is clear that this period is not a period of perfect floating as the period itself is the result of government action and full of government intervention) (Macleod A., 2012 and Broda 2003). The floating ERR in this period was characterized by destabilizing speculation and *beggar-thy-neighbor* devaluations (Nurkse 1944) cited in Broda 2003).

Then following the "United Nations (UN)" 1944 meeting in the US, Breton Woods, the famous Breton woods Pegged ERR (it is classified as adjustable peg by different economists because of some adjustments made) followed. This system also collapsed following the US huge domestic investment in the 1960s and huge spending at the Vietnam War, which together resulted in only 20% of the Dollar being backed by gold. Finally collapsed following the request of France for gold for its holdings of the dollar and the decision of US not to do so (The Nixon Act). According to Obstfeld and Taylor (1998), the Breton Woods system collapsed because of the increasing difficulty of preventing capital mobility (as cited in Broda 2003)

Following this event, an agreement (Smithsonian Agreement (1972)) was reached between the US and other governments to devalue the dollar and retain it backed by gold like the preceding system, but this system was also failed in 1973 because the US couldn't retain dollar backed by dollar even after the new exchange.

After the failure of the Breton Woods system, developed (western) countries decided to float their currency while developing countries of that time (mainly Asian countries) decided to remain pegged (adjustable or at the constant value) to the dollar. The western countries floating regime continued till the end of the 1970s.

In the late 1970s, European Community (EC) introduced a new system of exchange rate coordination called the Exchange Rate Mechanism (ERM). The deal was that member countries central banks would intervene in the market to keep their currencies exchange rate (with other European countries currencies) fluctuation within a 2.25% band. This system lasted for long with improvements until 1999 when Euro was introduced and initially conversion rates were set for European major currencies into the newly constructed Euro. On the other hand, the Asian countries adjusted peg system continued until the Asian Crisis of 1997, after which they failed to keep the peg (Macleod, 2012).

### **2.1.3 Classification of Exchange rate regimes**

There are different ways of classifying exchange rate regimes. For example, researchers for empirical reasons classify exchange rate regimes into three: Fixed, intermediate and floating exchange rate regimes. While major traditional theories classify them into two: fixed and flexible exchange rate regimes. The IMF and other multilateral organizations classify them into six to ten categories.

There are different alternative classifications of ERR based on different criteria's. The first classification of ERR of countries is based on the official declaration of countries. Classification based on this claim is called the De-jure classification. The other alternative classification is IMF de-facto classification which has been published annually since 1999. The classification mainly relies on the degree to which the exchange rate is determined by the market compared to official action (IMF, 2015).

On the other hand, different researchers also prepared their own classification based on different techniques. Levy-Yeyati and Sturzenegger (2003) analyzed data of the exchange rates combining with the level of international reserves held (as the level of reserve shows the power and intention to manage the exchange rate) using cluster analysis. They did this so that it enables them to account for both the exchange market intervention as well as exchange rate movements. Another group of economists, Reinhart, and Rogoff (2004, later improved by Ilzetzki (2017)) relied on the movement in the market-determined exchange rates. They did this because the actual exchange rates diverge from official rates in countries with parallel markets because of capital controls (Rose, 2011).

Here below are ten lists of exchange rate regimes based on the IMF (2014) report.

1. **No separate legal tender:** this is a system where the country does not have its own currency or abandon its own currency and the currency of another country circulates as the sole legal tender (formal dollarization). Adopting such an arrangement implies the complete surrender of the monetary authorities' control over domestic monetary policy.
2. **Currency board:** A currency board arrangement is a monetary arrangement based on an explicit legislative commitment to exchange domestic currency for a specified foreign currency at a fixed exchange rate, combined with restrictions on the issuance authority to ensure the fulfillment of its legal obligation. This implies that domestic currency is usually fully backed by foreign assets, eliminating traditional central bank functions such as monetary control and lender of last resort, and leaving little room for discretionary monetary policy. Some flexibility may still be afforded, depending on the strictness of the banking rules of the currency board arrangement.
3. **Conventional peg:** For this category the country formally (de jure) pegs its currency at a fixed rate to another currency or a basket of currencies, where the basket is formed, for example, from the currencies of major trading or financial partners and weights reflect the geographic distribution of trade, services, or capital flows. The country authorities stand ready to maintain the fixed parity through direct intervention (i.e., via sale or purchase of foreign exchange in the market) or indirect intervention (e.g., via the exchange-rate-related use of interest rate policy, imposition of foreign exchange regulations, an exercise of moral suasion that constrains foreign exchange activity, or intervention by other public institutions). There is no commitment to irrevocably keep the parity, but the formal arrangement must be confirmed empirically: the exchange rate may fluctuate within narrow margins of less than  $\pm 1\%$  around a central rate—or the maximum and minimum values of the spot market exchange rate must remain within a narrow margin of 2% for at least six months.
4. **Stabilized arrangement:** Classification as a *stabilized arrangement* entails a spot market exchange rate that remains within a margin of 2% for six months or more (with the exception of a specified number of outliers or step adjustments) and is not floating. The required margin of stability can be met either with respect to a single currency or a basket of currencies, where the anchor currency or the basket is ascertained or confirmed using statistical techniques. Classification as a stabilized arrangement requires that the statistical criteria are met and that the

exchange rate remains stable as a result of official action (including structural market rigidities). The classification does not imply a policy commitment on the part of the country authorities.

5. **Crawling peg:** The currency is adjusted in small amounts at a fixed rate or in response to changes in selected quantitative indicators, such as past inflation differentials vis-à-vis major trading partners or differentials between the inflation target and expected inflation in major trading partners. The rate of crawl can be set to generate inflation-adjusted changes in the exchange rate (backward looking) or set at a predetermined fixed rate and/or below the projected inflation differentials (forward-looking).

6. **Crawl-like arrangement:** For classification as a *crawl-like arrangement*, the exchange rate must remain within a narrow margin of 2% relative to a statistically identified trend for six months or more (with the exception of a specified number of outliers), and the exchange rate arrangement cannot be considered as floating. Usually, a minimum rate of change greater than allowed under a stabilized (peg-like) arrangement is required; however, an arrangement is considered crawl-like with an annualized rate of change of at least 1%, provided the exchange rate appreciates or depreciates in a sufficiently monotonic and continuous manner.

7. **Pegged exchange rate within horizontal bands:** The value of the currency is maintained within certain margins of fluctuation of at least  $\pm 1\%$  around a fixed central rate, or a margin between the maximum and minimum value of the exchange rate that exceeds 2%. It includes arrangements of countries in the ERM of the European Monetary System, which was replaced with the ERM II on January 1, 1999, for countries with margins of fluctuation wider than  $\pm 1\%$ . The central rate and width of the band are public or notified to the IMF.

8. **Other managed arrangement** This category is a residual and is used when the exchange rate arrangement does not meet the criteria for any of the other categories. Arrangements characterized by frequent shifts in policies may fall into this category.

9. **Floating:** A *floating* exchange rate is largely market determined, without an ascertainable or predictable path for the rate. In particular, an exchange rate that satisfies the statistical criteria for a stabilized or a crawl-like arrangement is classified as such unless it is clear that the stability of the exchange rate is not the result of official actions. Foreign exchange market intervention may be either direct or indirect and serves to moderate the rate of change and prevent undue fluctuations in the exchange rate, but policies targeting a specific level of the exchange rate are

incompatible with floating. Indicators for managing the rate are broadly judgmental (e.g., the balance of payments position, international reserves, and parallel market developments). Floating arrangements may exhibit more or less exchange rate volatility, depending on the size of the shocks affecting the economy.

10. **Free-floating:** A floating exchange rate can be classified as *free-floating* if intervention occurs only exceptionally and aims to address disorderly market conditions. Interventions should be limited to at most three instances in six months, each lasting less than three business days.

According to Johnson (1969), flexible exchange rates are rates of foreign exchange that are determined daily in the markets for foreign exchange by the forces of demand and supply, without restrictions imposed by governmental policy on the extent to which rates can move. While, A system under which countries commit themselves to maintain the foreign values of their currencies within a narrow margin of a fixed par value by acting as residual buyers or sellers of currency in the foreign exchange market, subject to the possibility of effecting a change in the par value itself in case of “fundamental disequilibrium” is called Adjustable Peg system.

As tried to mention at the beginning of this topic different researchers categorize them into three, for example, Broda (2003) classify as follows

1. **Modern fixed arrangements:** it includes truly fixed arrangements like the CFA franc zone; currency boards in which the monetary authority holds 100 % reserves in foreign currency against the monetary base, the money supply expands or contracts automatically with the state of the balance of payments and there is no role for the discretionary monetary policy including a lender of last resort; dollarization which goes one step forward and eliminates the national currency completely; and currency unions in which the members adopt the same currency.
2. **Intermediate arrangements:** it runs the continuum from an adjustable peg under which countries can periodically realign their pegs; to crawling pegs in which the peg is regularly reset in a series of devaluations; to a basket peg where the exchange rate is fixed in terms of a weighted basket of foreign currencies; to target zones or bands where the authorities intervene when the exchange rate hits pre-announced margins on either side of a central parity.

3. **Floating exchange rates:** the floating exchange rates category include free floats where the authorities do not intervene and allow the exchange rate to be determined by market forces; and managed floats where intervention is done to lean against the wind.

According to Frankel (2002), the demarcating line between fixed and intermediate arrangements is if the policy to fix is an institutional commitment. The line between intermediate and floating is if there is an explicit target zone around which the authority intervenes (sited in Broda, 2003).

#### **2.1.4 Theoretical arguments of exchange rate regime**

Even though the concept of ERR traces back to the nineteenth century the formal theories of ERR emerged after the great depression. The first theory of exchange rate and exchange rate determination was developed in the Keynesian framework by Lerner (1936) (cited in Sarno & Taylor (2002)).

Following the failure of flexible ERR of the interwar period, the well-known proponent of fixed exchange rate regime, Nurkse (1944) developed his argument against flexible ERR mainly from two perspectives. The first argument is that a flexible ERR is subject to speculative attacks. By speculative attacks he means that when the speculators of currency expect the currency to devalue in the future they speculate towards that direction which forces all speculators to speculate in the same direction and that force the currency to move in the direction that they want it to move, resulting in volatility of the currency regardless of the implication of macroeconomic fundamentals. The other related argument is the bandwagon effect, which is the situation in which small devaluation results in higher devaluation because of the fact that it leads the participants in the foreign exchange market to expect higher devaluation in the future and hold more foreign currency today resulting in artificial shortage and therefore more devaluation (Sarno and Taylor, 2002).

The proponents of fixed exchange rates also argue that fixed parities provide the best environment for the conduct of international trade and investment by removing the uncertainty which could have been caused by exchange rate fluctuations. Another argument frequently put forward in favor of fixed exchange rates is that the commitment to a fixed ERR provides a degree of discipline to the domestic macroeconomic policy that is absent if exchange rates are allowed to float (Keith and Pilbeam, 2006).

Against the argument of Nurkse (1944), Friedman (1953) came up with arguments for flexible ERR arguing that speculation can produce a stabilizing effect in the foreign exchange market. He argues that because speculations are made in the forward market and in a different direction they result in the stabilized exchange rate (Sarno & Taylor, 2002). According to Schuler (2012), Friedman also argues in favor of flexible ERR from the perspective of eliminating the exchange control, which he considers the factor hindering trade in goods and services.

Proponents of floating exchange rates also argue that in a floating regime the exchange rate automatically adjusts to ensure continuous equilibrium between the demand for and supply of currency because excess demand results in depreciation while excess supply results in the appreciation of the currency (Keith and Pilbeam, 2006).

Johnson (1969) in his argument for flexible ERR argued that the freedom of rates to move in response to market forces does not imply that they will move significantly or erratically, rather they will do so only if the underlying forces governing demand and supply are themselves erratic. He also argued that flexible exchange rates do not necessarily imply that the national monetary authorities must refrain from any intervention in the exchange markets; because whether they should intervene or not depends on whether the authorities are likely to be more or less intelligent and efficient speculators than the private speculators in the foreign exchange market. As to him a reasoned case for fixed international rates of exchange must run from analogy with the case for a common national currency (because the advantage of fixed ERR is increased integration like that of the common currency). He, therefore, recommended that the first best for the world is world money with a world monetary authority. But this recommendation faced strong opposition in the same year from Kindleberger (1969) mentioning that having a world monetary authority which fulfills the interest of everyone is impossible.

According to Keith and Pilbeam (2006), the choice between fixed and flexible exchange rate regimes depends on the objective of the authorities. They state that if the objective of the authorities is price stability using fixed ERR is good while using flexible ERR is better when the objective is income stability.

There are conflicting understandings regarding what was Friedman's stand in the choice of ERR. For example economists like Sarno and Taylor (2002), Schwartz A.; mention him as a strong supporter of flexible exchange rate regime. On the other hand, economists like Hank (2008),

Schuler (2012); argues that Friedman support both flexible ERR and fixed ERR stating both of them as a market mechanisms (Under a clean fixed exchange rate, the nominal exchange rate is fixed and market forces determine the nominal monetary base. Under a clean floating exchange rate, the nominal monetary base is in the short term set and market forces determine the nominal exchange rate). According to the later economists what Friedman dislike is intermediate arrangements, under which the monetary authority intervenes in the foreign exchange market to influence the nominal exchange rate and the nominal monetary base simultaneously, hindering market forces free movement and limiting market adjustment to some extent.

According to Hank (2008), Friedman also differentiated between Pegged and fixed exchange rate regimes. He described Pegged exchange rate regimes as regimes in which the monetary authorities seek to manage both the exchange rate and the monetary policy. Unlike floating and fixed rates, pegged rates invariably result in conflicts between monetary and exchange rate policies. For example, when capital inflows become “excessive” under a pegged system, a central bank often attempts to sterilize the ensuing increase in the foreign component of the monetary base by selling bonds, reducing the domestic component of the base. And when outflows become “excessive,” a central bank attempts to offset the decrease in the foreign component of the base by buying bonds, increasing the domestic component of the base. Balance-of-payments crises erupt as a central bank begins to offset more and more of the reduction in the foreign component of the monetary base with domestically created base money (Ibid, 2008).

Friedman, however, laid great stress on the fact that a fixed exchange rate administered by a central bank is dangerous. There is always the potential for a central bank to engage in discretionary monetary policy and to break the one-to-one link between changes in foreign reserves and changes in the money supply. Therefore, the country should either remove its central bank or let the market determine its value (flexible regime) (Ibid, 2008). When it comes to the developing countries Friedman argued developing countries should remove their central bank and exercise monetary union or use a currency of strong countries. He stresses that unifying currency for developing countries give them economic freedom (Ibid, 2008). A simple proof of his argument in developing countries is Japan (now Japan is termed as emerging country) in, for example, pumped a monetary base finally resulting in strong recession and stagnation in Japan

and its neighbors. <https://www.project-syndicate.org/commentary/exchange-rate-regimes-and-east-asia>

Regardless of what has been said before, there are three main arguments for some form of managed floating exchange rate regime. The first is that the authorities can choose an exchange rate more in line with economic fundamentals than the market (this does not seem to be true given strong speculators of these days). The second and probably the most important is that intervention is required to mitigate the costs of exchange rate 'overshooting'. Finally, the third one is that intervention is an appropriate instrument for smoothing necessary economic adjustments (Keith and Pilbeam, 2006).

Economists like Poole (1970), Turnovsky (1976), Boyer (1978), Parkin (1978), Genberg (1989) and Garber and Svensson (1995) focused on the criteria to be considered in making the choice between a monetary policy of interest rate targeting and a monetary policy of money supply targeting. These literature exploring the problem of choosing the optimal monetary and ERR are based on policy rules contingent upon the available, incomplete information on the underlying, unobservable *IS* (goods market equilibrium) and *LM* (money market equilibrium) shocks to minimize a weighted sum of the variances of output and inflation. The conclusion advanced by this literature is that if the variance of the *LM* shock is significantly larger than the variance of the *IS* shock, then a fixed ERR is to be preferred (and vice versa). If there is no significant difference between the variances of the two shocks, however, a managed floating regime is the optimal choice (Sarno and Taylor, 2002).

On the other hand, Rogoff (1985) argues that the optimal choice may be to appoint an independent, conservative central banker who does not share the societal utility function but rather places a very large (virtually infinite) weight on inflation-rate stabilization relative to employment-rate stabilization (Sarno and Taylor, 2006).

Giavazzi and Pagano (1988) and Currie (1992a) recommended pegging the exchange rate to the currency of a country with an independent, disciplined, conservative central banker and establishing a fixed exchange rate regime. Also, in these reputational models, a fixed multilateral exchange rate arrangement with other countries is expected to induce more discipline than a unilateral system because of the loss of reputation which would be incurred if the abandonment of the arrangement occurs (Sarno and Taylor, 2002).

Among other exchange rate regimes currency union has attracted attention since the beginning of the 1990s. However, there are so many arguments against the currency union mainly focusing on the concept of optimal currency area (first introduced by Robert Mundell (1961). According to Mundell currency union will be successful only if at least either wage/price flexibility or factor (labor and/or capital) mobility is fulfilled. However, if neither of the two is satisfied and hence wages and prices are ‘sticky’ and factor mobility is not high enough, then shifts in demand facing one region relative to another will lead to unemployment and inflation differentials unless nominal exchange rate flexibility is guaranteed. In this case, the loss of the chance of changing the exchange rate in order to offset the effect of demand shifts represents a significant cost for the countries joining an MU (monetary union) (Sarno and Taylor, 2002).

Nevertheless, according to De Grauwe (1975) Backus and Driffill (1985) in addition to the above costs, different preferences of countries towards inflation and unemployment make the establishment of a common currency costly. Bruno and Sachs (1985) Calmfors and Driffill (1988) also added differences in labor market institutions may induce a cost in an MU (Sarno and Taylor, 2002).

Overall, therefore, the literature quite pessimistic concerning the desirability and sustainability of currency union, at least under the traditional criteria defined by the early literature on optimum currency areas. Nevertheless, some criticisms of the theory of optimum currency areas need to be considered and also the benefits of monetary integration have to be taken into account before giving a final judgment on the desirability of a monetary union (Ibid, 2002). Among such benefits, the first and most important is that demand shifts tend to be symmetric across countries and even more symmetric in MU (which makes a policy made from the center effective for all members). Therefore, given this and other arguments in support of MU the study could conclude that giving up on your exchange rate mechanism by joining MU have a cost, but this cost is lower than which is assumed in the traditional analysis of optimum currency areas (Ibid, 2002).

### **2.1.5 Theories of Exchange rate determination**

Even if different theoretical arguments regarding the choice of ERRs exist after the interwar period like those of Nurkse and Friedman, formal theory of exchange rate determination was first developed in 1961 by Mundell and Fleming (1962) by extending the Keynesian income-expenditure model, introducing the capital market into the analysis. Following this development,

another theory of exchange rate determination assuming perfectly flexible prices (as opposed to fixed price assumption of Mundell) is developed in monetarist perspective. Then also following the breakdown of the Breton Woods system as a result of the volatility of the exchange rate the Dornbush sticky price model was developed in 1976 (Sarno & Taylor, 2002).

### The Mundell–Fleming model (M-F model)

The major contribution was to incorporate International capital movements into formal macroeconomic models based on the Keynesian IS-LM framework. The original Mundell–Fleming model assumed static expectations and constant price. Mundell (1962) and Fleming (1962) sought to examine the Implications of high capital mobility for a small country that had no ability to influence world Interest rates. Their papers showed that for such a country, the choice of ERR would have radical implications concerning the effectiveness of monetary and fiscal policy in influencing the level of economic activity.

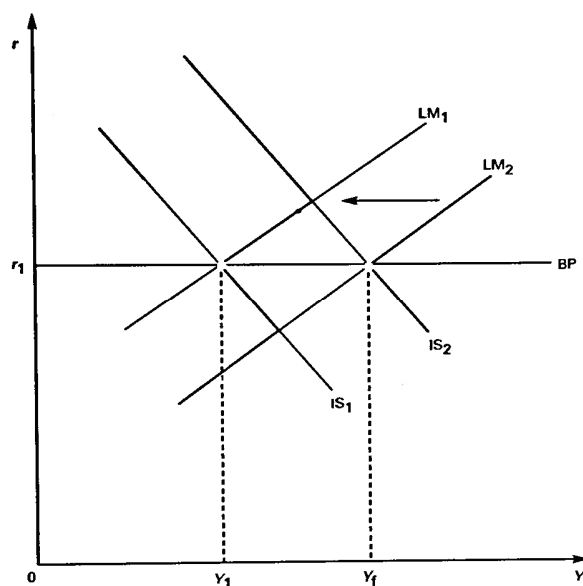


Figure 1: Fixed exchange rates and perfect capital mobility

Source: Keith and Pealbium (2006)

If the authorities attempt to rise, output by a monetary expansion the LM schedule shifts to the right from  $LM_1$  to  $LM_2$ , at the original  $IS_1$  there is downward pressure on the domestic interest rate and this results in a capital outflow. This capital outflow means that there is pressure for a devaluation of the currency; the authorities have to intervene in the foreign exchange market and, purchase the home currency with reserves. Such purchases result in a reduction to the money

supply in the hands of private agents. The purchases have to continue until the LM curve shifts back to its original position at  $LM_1$  where the domestic interest rate equals the international interest rate. Hence, with perfect capital mobility and fixed exchange rate, monetary policy is ineffective.

On the other hand under flexible ERR the downward pressure on the domestic interest rate resulting from monetary expansion, which intern results in capital outflow, result in depreciation of the exchange rate. The depreciation results in expansion of export and contraction in import so shafting the IS curve to the right ( $IS_2$ ) and the LM curve to the left ( $LM_2$ ) resulting in a new equilibrium at the higher level of income.

Therefore, According to the Mundell-Fleming model, a country cannot exercise a fixed ERR, perfect capital mobility and monetary policy at the same time.

### **The flexible-price monetary model (FPMM)**

The flexible price monetary model was developed by Frenkel (1976), Mussa (1976) and Bilson (1978). It assumes that purchasing power parity holds continuously. The model is based upon the premise that all prices in an economy are fully flexible; bonds are perfect substitutes and what matters for exchange rate determination is the demand for money in relation to the supply of money (Keith and Pealbium, 2006).

The final result of the model can be put below

$$s = (m - m^*) - \eta(y - y^*) + \sigma(r - r^*)$$

Where,  $s$  the nominal exchange rate,  $m$  the money stock,  $y$  the income level, and  $r$  the interest rate. The stars indicate the foreign level

The model implies that the nominal exchange rate of a country depends on the relative money supply, the relative income level, and relative interest rate. According to the model while the higher domestic income level decreases the exchange rate (Appreciation) the other factors (higher money supply and interest rate) increase the exchange rate level.

According to Sarno and Taylor (2002) even though the model has a remarkable contribution in exchange rate modeling it has serious limitations. First, it assumed the absolute purchasing power parity holds (which is almost a consensus nowadays as it doesn't). Second, its focus on a single market which is the money market for exchange rate determination (which is not true as

there are goods markets, Portfolio markets, Labor market and Foreign exchange market in addition to the money market.

### **The sticky-price monetary model (SPMM)**

As mentioned above the Dornbusch (1976) sticky-price monetary model is developed to explain the situation of highly volatile exchange rate following the failure of the Breton Woods system. It is assumed that there are ‘jump variables’ in the system i.e. exchange rates and interest rates jump their long-run compensating for stickiness in goods prices. For example, if there is cut in the nominal domestic money supply; since goods prices are sticky in the short run, this implies an initial fall in the real money supply and a consequent rise in interest rates in order to clear the money market. The rise in domestic interest rates then leads to a capital inflow and an appreciation of the nominal exchange rate (a rise in the value of the domestic currency in terms of foreign currency).

A short-run equilibrium is achieved when the expected rate of depreciation is just equal to the interest rate differential, i.e. when uncovered interest rate parity holds. Since the expected rate of depreciation must be non-zero for a non-zero interest rate differential, the exchange rate must have overshoot its long-run, purchasing-power-parity equilibrium. In the medium run, however, domestic prices begin to fall in response to the fall in the money supply. This alleviates pressure in the money market (the real money supply raises) and domestic interest rates start to decline. The exchange rate then depreciates slowly towards long-run purchasing power parity (Sarno and Taylor 2002).

Therefore, Dornbusch expected this will explain any fluctuation in the exchange rate which is unexplained by the macroeconomic fundamentals. However, it is not always the case as will be shown later.

According to Sarno and Taylor (2002), the major differences between the three models are on their assumptions on price and output. In the Mundell–Fleming model, the output is demand determined and prices are fixed. But, in the Dornbusch model, the output is at its natural level (at least in the long run) and prices adjust slowly to the excess demand. While, in the flexible-price monetary model, the output is at its natural level (like the Mundell-Fleming Model), but prices are flexible and adjust instantly in response to excess demand.

In general According to Keith and Pilbeam (2006) whichever monetarist model (M-F Model, FPMM, and SPMM) is adopted, a clear implication is that monetary policy is the only predictable and effective means of influencing the exchange rate. Moreover, since perfect substitution between domestic and foreign bonds is assumed there is no difference between the open market operation and Foreign exchange market operation.

Finally, in relation to our title, the monetarist models stress the authorities should abandon any attempt to influence the real exchange rate (in the long run), because it is determined by real and not monetary factors. Thus, in the long run (short run in the flexible-price version) the authorities should direct exchange rate management at stabilizing the domestic price level. Whether stabilizing the domestic price level will stabilize the nominal exchange rate depending upon the stability of the foreign price level and therefore upon the monetary policies of foreign countries. The authorities should not seek to stabilize the nominal exchange rate by the monetary policy because this may involve destabilizing the domestic price level if the foreign authorities are not pursuing stable monetary policies (Keith and Pilbeam, 2006).

### **Equilibrium models and liquidity models**

Equilibrium exchange rate models are first developed by Stockman (1980) and Lucas (1982). The model analyzes the general equilibrium of a two-country by maximizing the expected present value of a representative agent's utility, subject to budget constraints and cash-in-advance constraint (by convention, agents are required to hold local currency, the accepted medium of exchange, to purchase goods). Equilibrium models are an extension or generalization of the FPMM allowing for multiple traded goods and real shocks across countries. According to the general equilibrium model, demand shifts are the reasons for the observed volatility of nominal exchange rates in excess of volatility in relative prices (Sarno & Taylor, 2002).

Like the FPMM relative changes in money supply affects the nominal exchange rate, but the general equilibrium model differs from the FPMM in its conclusion in many respects either qualitatively or quantitatively or by explaining concepts unexplained in FPMM model (like the inflation rate) (Ibid, 2002).

The Liquidity model is an extension on the equilibrium model by incorporating new cash-in-advance constraint on agents to purchase assets (in addition to the cash in advance constraint to

purchase goods in the case of the earlier general equilibrium model). The model was first developed in this context by Lucas (1990) (Ibid, 2002).

Among the models developed in this framework Grilli and Roubini (1992), for example, in their two-country model showed the money supply and bond issue of each country linked through the government budget constraint, and agents must decide on how much domestic and foreign currency to hold in order to purchase domestic and foreign goods and assets. Once this decision is made, subsequent shocks to bond and money supplies will affect nominal interest rates and also, since the expected rate of monetary *growth* is unaffected (as opposed to the *level* of the money supply), expected inflation is unaffected, this will affect real interest rates (through the nominal interest rate). This in turn finally affects the nominal and real exchange rates (Sarno and Taylor, 2002)

In addition to the above models developed in a static framework, Beaudry and Devereux (1995) constructed a dynamic general equilibrium model designed to explore the relationship between money shocks and the real exchange rate. A crucial feature of this model is the presence of increasing returns to scale in technology. This allows for equilibrium in monopolistic competitive price-setting in which prices are endogenously sticky. Hence, the combination of increasing returns to scale and short-term price stickiness leads to significant money non-neutrality. Under a floating exchange rate system, a monetary shock induces an immediate and persistent nominal and real depreciation as well as persistent positive effects on output, consumption, and investment (Ibid, 2002).

The differences between equilibrium and disequilibrium models (the previous three models) of exchange rate determination involve their policy implications. In particular, in equilibrium models, the government cannot affect the real exchange rate by changing the nominal exchange rate. Furthermore, equilibrium models of the exchange rate imply that changes in the exchange rate do not induce changes in inflation. Hence, exchange rate changes are not helpful, for example, in formulating monetary policies designed to keep inflation low; which also implies that the choice of the ERR to be employed is not very important for the real exchange rate or the trade balance. Consequently, in an equilibrium model framework, undervalued or overvalued currencies are not an important issue and governments should not use, in principle, protectionist policies as a reaction to changes in the exchange rate (Ibid, 2002).

Overall, the main implication of the equilibrium theory of the exchange rate is that exchange rate behavior is consistent with the notion that markets work properly if they are permitted to do so (Stockman, 1987) (cited in Sarno and Taylor, 2002).

### **The portfolio balance model (PBM)**

According to Keith and Pilbeam (2006), the model is first developed by Jeffrey Frankel (1983 and 1984) as an extension of his flexible price monetary model to incorporate a portfolio balance effect.

In common with the class of monetary models, the level of the exchange rate in this model is determined by the supply of and demand for financial assets, at least in the short run. A distinguishing feature of the portfolio balance model (PBM) among exchange rate models is the assumption of imperfect substitutability between domestic and foreign assets. Moreover, the exchange rate is the main determinant of the current account balance which determines net domestic holdings of foreign assets, which influences the level of wealth, and in turn the level of the demand for assets, which ultimately affects the exchange rate. The PBM is, therefore, a dynamic model of exchange rate determination based on the interaction of asset markets, current account balance, prices and the rate of asset accumulation (Sarno and Taylor, 2002).

The model has many contributions. First, it allows us to distinguish between short-run, or flow equilibrium and the dynamic adjustment to the long-run, stock equilibrium. Second, it allows a role for changes in perceived risk or risk-aversion in determining the exchange rate. Third, it considered the role of the current account in the determination of the exchange rate over time. A significant policy implication that emerges from the portfolio balance model is that a given change in the money stock has a more powerful effect on the exchange rate when carried out by a purchase of foreign assets (FXO) than when achieved via a purchase of domestic assets (OMO). An important omission in this model according to Keith and Pilbeam is that it does not explicitly explain why risks in foreign and domestic bonds are perceived to be different (Keith and Pilbeam, 2006).

## 2.2 Review of Empirical Literatures on exchange rate regime and economic performance

This section is about the review of empirical evidence on the effect of ERR on economic performance from the perspective of different major macroeconomic performance indicators. The chapter will present empirical evidence divided into four sub-sections. The section first presents empirical evidence on the relationship between ERR and economic growth. Then it is followed by the second sub-section presenting empirical evidence on the relationship between ERR and inflation. The third sub-section is about the evidence on the correlation between ERR and capital mobility. Finally, the section is concluded by the sub-section presenting the relation between ERR and the likelihood of an economic crisis.

### 2.2.1 Exchange rate regime and economic growth

Josheski, Ljubica, and Cane (2011) studies the relationship between economic growth, unemployment and ERR for five fixed ERR and five flexible ERR following small open European countries. The study used graphical scatter plotting, correlation matrix and ordinary least square and found that the fixed ERR is weakly but positively correlated with economic growth.

However, the study found their paper not to be dependable from different perspectives. First, they used less formal methods of analysis. Second, they do not consider the endogeneity problem in their regression. Third, as they themselves showed their model fails to pass some of the Gous-Markov tests in some cases and test of stationary.

Broda (2002) wrote the article on Terms of trade and exchange rate regimes in developing countries. The sample used by the researcher consists of annual observations for developing, non-oil producing countries with populations larger than 1 million ***for seventy-five developing countries from 1973 to 1996***. Broda employed a VAR model with Standard time-series tests that further suggest four lags. The short-run real GDP response to terms-of-trade changes is significantly smaller in countries with flexible exchange rate regimes (floats) than in those with fixed regimes (pegs) (since his analysis is based on negative shocks it means that the real GDP is less affected by fluctuations of TOT in the flexible regimes). He finally concluded that the

importance of terms-of-trade shocks in explaining the variance of real GDP, real exchange rates, and prices varies considerably across time periods but less so across regions.

Comparing the result of this study with that of Josheski et al (2011) the study found strong opposition and given the methodology and length of sample and observations the finding of Broda is stronger. However, the paper of Broda could be criticized in the sense that it does not directly analyze the effect of ERR itself on economic performance rather it analyzes the effect of TOT on economic growth in different exchange rate regimes.

Levy-Yeyati and Sturzeneger (2003) studied the issue using data of 183 countries from 1974-2000. What makes this study special is that it used its own de-facto classification against the de-jure classification. The authors studied their whole sample and also by dividing their sample into two groups (i.e. Industrialized (advanced) countries vs. LDC countries). They started their analysis with simple mean and median analysis and checked the robustness of their result using pooled regression.

Levy-Yeyati and Sturzeneger (2003) found that for LDC countries less flexible regimes are related to slower growth and greater volatility of output. From their descriptive analysis, they found that regardless of the type of regime classification (whether De-jure or De-facto) floating regimes over perform pegged regimes. Their pooled regression also supported their earlier finding. However, after segregating their sample into industrial and developing countries they reported that the story works only for LDCs and regimes do not matter for industrialized countries. They also found that their de-facto classification shows a more consistent result. Finally, they tested the possibility of their results being affected by their classification by excluding the controversial observations from the de-jure classification; from this, they concluded that their result is not affected by their classification.

The above paper is a very nice work from different perspectives. First the fact that it covers a very large sample covering most countries of the world starting from breaking down of the Bretton-Woods system, after which the world ERRs diversified. Moreover, the authors used their own de-facto classification which is more comprehensive than any de-facto classification before that. However, the study used simple analysis tools like mean and median and also simple pooled regression which are both known a day's keen to criticism.

Bohl et al (2016) study the impact of ERRS on economic growth using a panel of 41 sample countries of the world for the period from 1980-2010. This study is different from those listed above in that it includes an interaction of regime dummies with different fiscal and monetary policy variables. It also included analysis for all sample countries and also the sample countries segregated into groups like G-20, Advanced, and emerging countries. The study runs regression using fixed effects, first difference GMM and system GMM models.

The study of Bohl et al(2016) found that unlike Levy-Yeyati and Sturzeneger (2003) for a panel of all countries pegged regimes are the worst for economic growth while crawling regimes are best. Segregating the countries, the study found crawling regimes are best for a G-20 country while pegged is best for emerging countries. As in Levy-Yeyati and Sturzeneger (2003), ERR had a negligible impact on economic growth for advanced countries, but in band regimes. More importantly, the study found that adopting pegged regimes is bad for all countries economic growth at the time of any type of financial crisis.

Bohl et al (2016) is a very nice study with the exception of the following drawbacks. First, and most importantly, it used the de-jure classification of ERR, as there is no de-facto classification before the 1990s. Using de-jure classification is now a day's not acceptable except for comparison. Secondly, it used only 41 countries which are very small to segregate into three groups. Finally, though it is formally published in 2016 it used data only until 2010 when the financial crisis is not fully completed.

Gosh (2014) used a model derived from the Solow growth model to study the impact of ERR on economic growth using the data of 156 countries for the period between 1999 and 2012. The researcher started his analysis by explaining the trend of ERR data. Even though later checked for the robustness using its own de-facto flexibility analysis, the study mainly used the IMF de-facto classification of ERR. The study employed most of the conventional econometric methods from the pooled OLS to GMM including the IV method, with the exception of fixed and random effect methods. Unlike others (for example, Levy-Yeyati & Sturzeneger (2003) and Bohl et al (2016)) the researcher moved forward to see the result for each continent.

Gosh (2014) stated that among ERRs polar (fixed and flexible) regimes dominate in emerging and low-income countries, but after 2007 the distribution of regimes is symmetric. On the other hand, Gosh found flexible regimes to be dominant in advanced countries. Like in Levy-Yeyati

&Sturzeneger from the descriptive statistics the study reported flexible regimes to promote economic growth, except after 2006 where intermediate regimes performed better. In its IV method unlike in the descriptive analysis, the study found that Intermediate regimes hinder growth with fixed being insignificant. In the GMM method, it found the opposite of the result of the IV method, as it found that fixed regimes demote growth, while intermediates are insignificant. In all the methods the flexible method remained positive for economic growth.

Gosh (2014) seems to have done everything in his hand to check for the robustness of its result. The researcher mentioned that following Bayoumi & Eichengreen (1998), he prepared its own flexibility index by using changes in the exchange rate and foreign reserve. This method also sustained his previous findings of flexible regimes motivating economic growth. The researcher categorized the countries into groups and unlike the two earlier papers reported that ERRs matter for economic growth even for advanced countries. The researcher also moved forward to divide the observations according to their continent. Gosh found that fixed regimes lower growth for all continents except Asia, where the fixed regime was found insignificant and intermediate regimes promote growth (insignificant for other continents).

As anybody can observe the paper is comprehensive and excellent work by a famous IMF economist with some limitations. The first limitation is the time coverage because the study covered data only of thirteen years. The second and more important limitation is that it categorized IMFs more than ten regimes into three where he merged conventional peg with other types of stronger pegs and managed floating with free floating. The third limitation was not trying the fixed and random effect methods which come to the mind of anybody dealing with panel data and did not try to explain why.

### **2.2.2 Exchange rate regimes and Inflation**

Sissoko and Dibooglu (2005) examined the exchange rate system and macroeconomic fluctuations in Sub-Saharan Africa. They classified SSA into two subgroups of countries for examining the major sources of macroeconomic fluctuations in the area. I.e. the CFA (“Communaute´ Financie`re Africaine” in West Africa and “Cooperation Financie`re en Afrique Centrale” in Central Africa) Franc countries and the non-CFA countries. The researchers employed a restricted structural VAR framework.

They concluded that a fixed exchange rate system (The CFA) helps maintain price stability by limiting monetary discretion. However, he also concluded that this fixed exchange rates may fail to insulate these economies against external disturbances, and without additional fiscal fine-tuning, the result is a loss of competitiveness. On the other hand, he found that the non-CFA countries have had faster output growth than the CFA zone.

Generally, the implication of this study is more or less in line with the theoretical arguments. But the paper can be criticized from the perspective of its generalization of non-CFA countries into one group as they follow different exchange rate regimes (for example Uganda follow flexible regime while Ethiopia follows managed floating (de-jure)).

Bleaney and Francisco (2005) using data from a large sample of developing countries from 1985 to 2001 and using OLS (ordinary least square), fixed effects and GMM estimation methods, including country fixed effects and dummy variables for three kinds of ERRs, found that hard pegs (currency boards or a shared currency) reduce inflation and money growth and there is no evidence that soft pegs confer any monetary discipline, after other factors are controlled for. They also concluded that Inflation triggers regime switches. Finally, they concluded only hard pegs affect inflation (reduce inflation).

The result of Blaney and Fransisco is in line with the result of Sissoku and Dibougou. Moreover, their results are in line with the recommendation of Friedman for LDCs (to peg their currency with strong countries).

However, their result is in clear contradiction with Jackson and Miles (2008) who analyzed the effect of fixed ERR on inflation using the sample of 75 LDCs from 1970-1998, for which they obtained institutional (International Country Risk Guide (ICRG)) ratings. They simply applied pooled least squares, using robust standard errors. They found that once the institutional effects are considered the choice of fixed ERR do not have a significant effect on inflation. This suggests that fixed exchange rates exert at most a contingent (on institutional quality) effect on inflation.

Even if, the above study performs better compared to the previous studies by including institutional factors however it is worse-off in its estimation technique because it did not apply formal panel data estimation methods like fixed effect and GMM which consider the effect of lagged values.

### **2.2.3 Exchange rate regime and Capital Mobility**

Barajas, Erickson and Steiner (2008), regressed the sovereign debt spreads against a set of explanatory variables that reflect exchange rate policy, domestic fundamentals, and global financial conditions. They found that capital markets do not penalize countries using fixed ERRs and also do not reward countries following flexible regimes in de-jure terms. They also go further and analyzed why de-facto and de-jure ERRs vary and why countries actually intervening declare they are following fixed exchange rate regimes and concluded that it might be because flexible exchange rate regimes perform better in hard times (economic crises).

### **2.2.4 Exchange rate regime and the likelihood of economic crises**

Chiu and Willett (2009) analyzed the stability of alternative exchange rate regimes in the face of substantial capital mobility. They used dataset 21 industrial countries, 42 emerging markets economies, and 27 low-income developing countries from 1990 to 2003. They also used de-facto rather than de-jure regimes and they took into account the institutional factor (weakness of government). They concluded that weak government increases the likelihood of a crisis in any ERR and the effect is worse under the intermediate regimes. They stated their result is in line with the finding of Willett (2006) who found that weak governments increase the likelihood of a crisis in any regime and it worsens as we move from the flexible regime.

However, as it can be observed the results are not the same in the sense that the first implies fixed regime also performs well like flexible regime while the latter implies it perform worse. But both studies are the same from the perspective of the mixed regime.

Hoffmann (2010) studied the reverse (effect of financial markets on exchange rate regimes). He used the stochastic two-economy world model, the structure of which is based on Obstfeld and Rogoff (2000a) and Sutherland (2006), agents of the home country and foreign country produce traded goods. Foreign country conditions, indicated by an asterisk, are defined analogously. They concluded that there is no single ERR that outperforms the others in stabilizing both domestic consumption and output variability in the process of financial market integration.

It confirms the result of the study by Barajas et al (2008) mentioned above which concludes the financial market does not discriminate among regimes.

## ***Summary of the Empirical Literatures***

**Table 1: Summary of Empirical Literatures**

| <b>Outer and Year</b>            | <b>Title of the Paper</b>                                                                         | <b>Methodology</b>                                                                                                                                                                                               | <b>Conclusion</b>                                                                                                                                                                    |
|----------------------------------|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Josheski et al (2011)            | <i>The macroeconomic implication of exchange rate regimes</i>                                     | <ul style="list-style-type: none"> <li>• Using data of 10 small central Eastern European countries from 1993-2011</li> <li>• It used scatter plotting, correlation matrix &amp; ordinary least square</li> </ul> | Fixed ERR is weakly but positively correlated with economic growth                                                                                                                   |
| Broda (2002)                     | <i>Terms of trade and exchange rate regimes in developing countries</i>                           | <ul style="list-style-type: none"> <li>• Used data of 75 non-oil exporting developing countries from 1973-1996</li> <li>• It used VAR model with four lags</li> </ul>                                            | The short-run real GDP response to TOT changes is significantly smaller in countries with flexible ERR than in those with fixed regimes                                              |
| Levy-Yeyati & Sturzeneger (2003) | <i>To Float or to Fix: Evidence on the Impact of Exchange Rate Regimes on Growth</i>              | <ul style="list-style-type: none"> <li>• Using data of 183 countries from 1974-2000</li> <li>• Used simple mean and median analysis and pooled regression</li> </ul>                                             | For LDC countries less flexible regimes are associated with slower growth and greater volatility of output. ERRs does not matter for advanced countries                              |
| Bohl et al (2016)                | <i>Austerity and recovery: Exchange rate regime choice, economic growth, and financial crises</i> | <ul style="list-style-type: none"> <li>• Using panel of 41 countries of the world from 1980-2010</li> <li>• The study run regression using Fixed effects, first difference GMM and system GMM models</li> </ul>  | Crawling regimes are best for G-20 countries while, pegged is best for emerging countries. ERR had negligible impact on economic growth for advanced countries, but in band regimes. |
| Gosh A. (2014)                   | <i>Do Exchange Rate Regimes Matter For Economic Growth?</i>                                       | <ul style="list-style-type: none"> <li>• Used data of 156 countries between 1999 and 2012</li> <li>• It used trend analysis, Pooled OLS, IV method and GMM</li> </ul>                                            | Flexible ERR is positively associated with economic growth. Fixed regime lower growth in both advanced and low income countries, while intermediates are insignificant.              |
| Sissoko & Dibougou (2005)        | <i>The exchange rate system and macroeconomic fluctuations in Sub-Saharan Africa</i>              | <ul style="list-style-type: none"> <li>• Using data of around 30 Sub-Saharan countries from 1960-2000</li> <li>• It employed a restricted structural VAR framework</li> </ul>                                    | Fixed ERR (The CFA) helps maintain price stability by limiting monetary discretion                                                                                                   |
| Bleaney and Francisco (2005)     | <i>Exchange Rate Regimes and Inflation: Only Hard Pegs Make a Difference</i>                      | <ul style="list-style-type: none"> <li>• Using data of 102 developing countries from 1985 to 2001</li> <li>• Using pooled OLS, fixed effects and GMM methods</li> </ul>                                          | Inflation triggers regime switches. Only hard pegs help reduce inflation                                                                                                             |
| Jackson & Miles (2008)           | <i>Fixed Exchange Rates and Disinflation in Emerging Markets: How Large Is the Effect?</i>        | <ul style="list-style-type: none"> <li>• Using the data 75 less developed countries from 1970-1998</li> <li>• It applied pooled least squares with</li> </ul>                                                    | The effect of ERR on inflation is dependent on institutional quality and                                                                                                             |

|                         |                                                                                                                      |                                                                                                                                                                                                                                                         |                                                                                                                                                                   |
|-------------------------|----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         |                                                                                                                      | robust standard errors                                                                                                                                                                                                                                  | only pegged regimes with strong institutions reduce inflation                                                                                                     |
| Barajas et al (2008)    | <i>Fear of Declaring: Do Markets Care What Countries Say about Their Exchange Rate Policies?</i>                     | <ul style="list-style-type: none"> <li>• Using quarterly data of 22-31 countries observed from fourth quarter of 1997 to second quarter of 2006</li> <li>• It used methods like descriptive statistics, fixed effects and correlation matrix</li> </ul> | Capital markets do not penalize countries using fixed ERR nor reward countries following flexible ERR in de-jure terms                                            |
| Chiu and Willett (2009) | <i>The Interactions of Strength of Governments and Alternative Exchange Rate Regimes in Avoiding Currency Crises</i> | <ul style="list-style-type: none"> <li>• Used data of 21 industrial, 42 emerging and 27 low-income countries from 1990 to 2003</li> <li>• Used probit regression undertaken by applying an interaction dummy regression model</li> </ul>                | Weak governments increase the likelihood of crisis in any ERR and the effect is worse under the intermediate regimes                                              |
| Hoffmann M.(2010)       | <i>International financial markets' influence on the welfare performance of alternative exchange rate regimes</i>    | <ul style="list-style-type: none"> <li>• Used Stochastic two-economy world model in the General Equilibrium approach</li> </ul>                                                                                                                         | There is no single ERR that outperforms the others in stabilizing both domestic consumption and output variability in the process of financial market integration |

## 2.3 Evaluation of the theoretical literature

Before going to see the efficiency of the foreign exchange theories the study shall see the efficiency of the foreign exchange market itself. The efficient market in the specific application to the foreign exchange market implies that market participants use all relevant available information bearing on the appropriate value of the exchange rate to produce a set of exchange rates (spot and forward) that does not provide an opportunity for unusual ex-ante profit opportunities.

One of the most popular tests of the efficiency of the foreign exchange market has been to see whether the forward exchange market systematically over or under-predicts the future spot exchange rate or not. Then if the forward market wrongly predicted it we call the foreign exchange market is inefficient. This test is called the efficient market hypothesis.

The rational expectations hypothesis (REH) is particularly useful when examining the concept of exchange market efficiency, because like the efficient market hypothesis (EMH) it presumes that economic agents do not make systematic errors when making their predictions. Assuming there is no risk premium using the REH Levich (1978) and Frenkel (1982a) prepared their foreign

exchange market inefficiency test. According to this test, if the foreign exchange market is efficient in the sense that the exchange rate (spot and forward) incorporates all currently available information and there is no risk premium in the foreign exchange market, then the forward rate will be an unbiased predictor of the future spot exchange rate. The two authors tested their model and found their results supportive of the foreign exchange market efficiency and no risk premium.

However, later authors like Hansen and Hodrick (1980), Meese and Singleton (1982) and Cumby and Obstfeld (1984) have pointed out that the Levich and Frenkel regression is inappropriate if exchange rates follow a non-stationary process. Cumby and Obstfeld (1984) estimated the model accounting for the trend in the exchange rate, and found that the foreign exchange participants significantly over or under-predicted the foreign exchange rate. One should be careful in interpreting this result as it is not clear whether the problem is due to the market inefficiency or presence of risk premium.

### **2.3.1 Testing the foreign exchange determination models**

The FPMM found a little empirical validity (which is why models are developed for in the first place). Frenkel (1976), Hodrick (1978) and Bilson (1978) also found strong evidence in support of the model (FPMM) for the German mark–US dollar exchange rate during the German hyperinflation of the 1920s. Putnam and Woodbury (1980) also estimated the FPMM for the sterling-dollar exchange rate over the period 1972 to 1974 and found the variables to be significant but less than the implication being the only factors affecting the exchange rate. However, after the 1970s as Frankel (1979) himself accepted the FPMM ceases to be empirically valid.

Like in the case of the FPMM the evidence for the SPMM is also weak when the data period is extended beyond the late 1970s. For example, while Driskell (1981) reports single-equation estimation results largely favorable to the SPMM for the Swiss franc-US dollar rate over the sample period 1973–77, Backus (1984) finds little support using US-Canadian data for the period 1971–80 (Sarno and Taylor, 2002).

One testable implication of the simplest equilibrium models is the neutrality of the exchange rate with respect to the ERR since the real exchange rate is (determined by real variables). However,

Stockman's (1983) study of thirty-eight countries over a variety of time periods does conclude that real exchange rates are significantly more volatile under floating rate regimes than that of fixed regime. Moreover, Clarida and Gali (1994), Eichenbaum and Evans (1995) (for the US), Grilli and Roubini (1993) (for the other G7 countries) and Nana, Hall and Philpott (1995) (for New Zealand and Australia) tested the models provided evidence that unanticipated monetary contractions lead to increases in the level of domestic interest rates and an appreciation of the domestic currency in both real and nominal terms, which is inconsistent with most equilibrium models in which nominal shocks should not affect real variables, but is consistent with liquidity models with asset market cash-in-advance constraints (Sarno and Taylor, 2002).

Lewis (1988) estimated foreign bond demand equations from the PBM for five countries: the US, the UK, Germany, Japan, and Canada by considering cross-equation constraints and provided some support to the model. Dominguez and Frankel (1993) studied the effectiveness of exchange rate intervention for the US dollar– German mark and US dollar-Swiss franc bilateral exchange rates during the 1980s, by measuring the risk premium using survey data and showed that the resulting measurements can be explained by the portfolio balance model (Sarno and Taylor, 2002).

In addition to the individual tests mentioned another way of examining the empirical validity of exchange rate models is to examine their out-of-sample forecasting performance. In a landmark paper, Meese and Rogoff (1983) compare the out-of-sample forecasts produced by various exchange rate models with forecasts produced by a random walk model, by the forward exchange rate, by a univariate regression of the spot rate and by a vector auto-regression. The conclusion which emerges from this study is that on a comparison of root mean square errors, none of the asset market exchange rate models outperforms the simple random walk model. Woo (1985) and Finn (1986) went further in that they estimate the rational expectations form of the FPMM adding a partial adjustment term in money demand and hence perform a forecasting exercise of the type of Meese and Rogoff. Woo finds that his formulation outperforms the random walk model in terms of both the mean absolute errors and the root mean square errors for the German mark–US dollar exchange rate. Finn's results are slightly weaker in that the model forecasts do not beat, but do as well as, the random walk model (Keith and Pilbeam, 2006).

The study could conclude that, although the theory of exchange rate determination has produced a number of plausible models, empirical work on exchange rates has still not produced models that are sufficiently statistically satisfactory to be considered reliable and robust, either in-sample or in out-of-sample forecasting, or which help us discriminate between the various theories. Overall, the empirical studies reveal that the failure of existing exchange rate models is quite general (Sarno & Taylor, 2002 and Keith & Pilbeam 2006).

## 2.4 Conceptual Framework

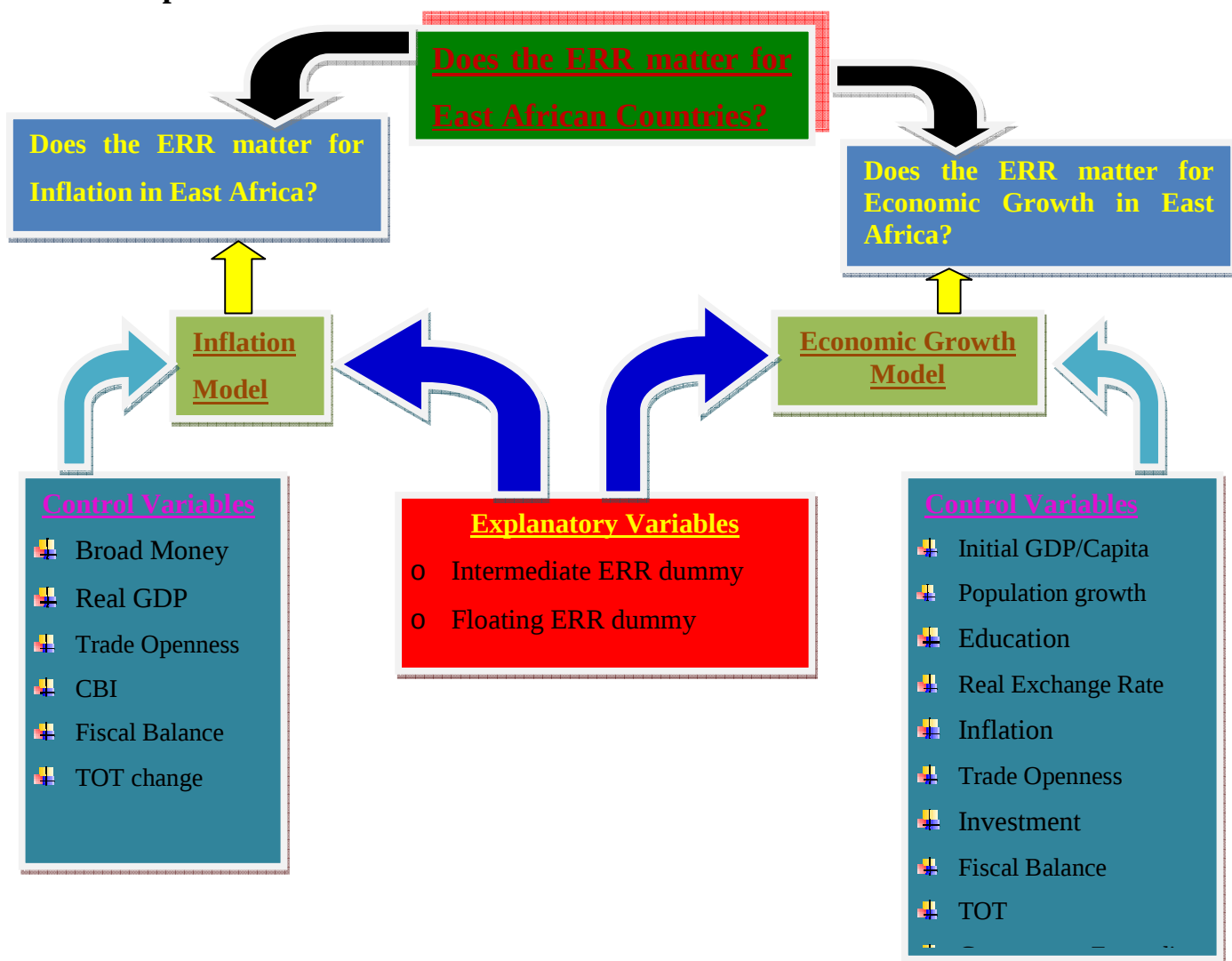


Figure 2: Conceptual Framework

## **CHAPTER 3: DATA AND METHODOLOGY**

To achieve the major objectives of this paper, which are analyzing the association between ERR and Economic growth as well as Inflation in East Africa; the study used secondary data collected from different journals and organizations. To analyze the data the study employed both descriptive and econometric methods of analysis. The detailed explanation of the methodology is explained under the following sub-topics.

### **3.1 Data collection and source**

The study completely relayed on secondary data collected from official web pages of different international organizations and Journals. Data of the dependent variables i.e. Real GDP and Inflation were collected from IMF 'world economic outlook' (WEO) database. The data of our major explanatory variable which is ERR was collected from IMF 'Annual Report on Exchange Arrangements and Exchange Restrictions' (AREAER) which is published on yearly bases. As well as, De facto ERR classification data of Ilzetzi, Reinhart, and Rogoff updated on December 2016 to compare results with that of IMF classification. Data of most of the control variables is collected from IMF-WEO database and WB-WDI database with the exception of central bank independence (CBI) data (which is from Garriga 2016) and World Governance Indicator (WGI) data (from WGI database of WB).

The panel data of all the above-mentioned variables from the respective sources was collected for 11 (eleven) East African countries; namely Burundi, Ethiopia, Kenya, Madagascar, Malawi, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe. The data was collected for the years ranging from 1996-2016. However, Zimbabwe has later dropped due to poolability and the number of countries was reduced to 10 (ten).

### **3.2 Method of Data Analysis**

The Collected data was organized into the appropriate panel form. Even though the study focused on the econometric method of analysis, it used both the descriptive and econometric methods of data analysis.

The descriptive analysis had the following features. It included a presentation of different line and bar graphs postulating the relationship between our explanatory variable, which is ERR and

our dependent variables, which are Real GDP and Inflation. It also included a tabular presentation of the summary statistics of the data across sample units and observation years. Furthermore, it included a detailed explanation of the graphical and tabular presentations in statement forms according to the researcher's understanding of economic theories and previous literature.

The econometric analysis started from the multivariate pooled least square regression analysis recommended and used by IMF (2016) World Economic and Financial Surveys Regional Economic Outlook on Sub-Saharan Africa as a baseline. IMF (2016) argues against using fixed effect estimation technique for ERR because if there is no change in a countries exchange rate regime over the observation years, fixed effect estimation will create a bias. Therefore, as recommended by IMF (2016) the study used the multivariate pooled least square regression with annual fixed effects and robust standard errors.

Even though, IMF (2016) recommends pooled least square, many researchers on the topic including top economists like Bohl et al (2016), Gosh et al. (2002), Jackson and Miles (2008) and Bleaney and Francisco (2005) recommend performing fixed effect estimation to check robustness of the pooled regression result. The reason for conducting fixed effect is because the former ignores country specific characteristics which might significantly affect the estimation. Jackson & Miles (2008) and Bleaney & Francisco (2005) found that using fixed effect, as it considers unobserved country heterogeneity, results in a significant change on the estimation result and decreases the estimates of ERRs.

However, Bleaney & Francisco (2005), Lartey (2017), Bohl et al (2016), De Vita and Kyaw (2011) and Ghosh (2014) recommend going further forming a dynamic model estimated by System Generalized Method of Moments (SYS-GMM) estimation method. The reason for using SYS-GMM according to Bohl et al. (2016) mainly emerges from the fact that fixed effect estimation considers country fixed effect in the estimation which has an advantage of increasing fit of the model and accounting for unobserved heterogeneity but it is associated with endogeneity problem because the country fixed effect could be correlated with some explanatory and control variables.

De Vita & Kyaw (2011) and Ghosh (2014) also agree with Bohl (2016) that SYS-GMM solves the endogeneity problem in fixed effect estimation. More importantly, according to Gosh (2014),

SYS-GMM accounts for the dynamic behavior of macroeconomic variables i.e. macro variable like our dependent variables of Inflation and GDP are dynamic in nature as their own lagged value significantly affect the present or future value.

Therefore, based on all the above arguments the study used the following multiple estimation techniques. First, it started from the above mentioned IMF (2016) recommended pooled least square regression with time fixed effects and robust standard errors. Second, it runs the fixed effect estimation model which accounts for both time fixed and country fixed effects. Then finally, it reformulated the model into a dynamic model and run SYS-GMM estimation. By doing so, it checked the robustness of results and proved the significance of estimation techniques on affecting our estimation result.

### 3.3 The Models

As explained under section-1.3 the paper investigates whether the choice of ERR matters for the economic performance of East African countries by focusing on two macroeconomic performance indicators; namely, RGDP and Inflation. The models used in this paper can be categorized into two groups based on the macroeconomic performance indicator they deal with (i.e. the dependent variable).

#### 1. Inflation Model

To analyze whether the ERR matters for the level of inflation or not, the study used multiple models starting from the exact model of IMF (2016).

The first model which was estimated using pooled least square can be specified as follows:

$$\text{Equation (1)} \quad \pi_{it} = \beta_0 + \beta_1 X_{it} + \alpha_1 \text{float} + \alpha_2 \text{int} + \gamma_t + \epsilon_i$$

Where, ' $\pi$ ' is the dependent (explained) variable which is the level of inflation measured by average consumer prices.  $\beta_0$  is the intercept.  $X_{it}$  is the vector of control variables i.e. variables that affect the level of inflation other than our variable of interest while  $\beta_1$  is the coefficient of those variables. The control variables in this study initially included variables in the IMF (2016) which are; the growth of broad money, Real GDP, trade openness, CBI, fiscal balance and term of trade (TOT) change. 'float' and 'int' are dummy variables for floating and intermediate ERRs respectively while;  $\alpha_1$  &  $\alpha_2$  are the coefficients for floating and Intermediate regimes, respectively.

' $\gamma_t$ ' controls for year-specific factors affecting inflation and ' $\varepsilon_i$ ' is the error term. According to Bleaney & Francisco (2005), the year dummies prevent the relationship between ERR and inflation from being affected by the time-series relationship between them.

The above model is based on the IMF three category coarse exchange rate arrangement. The model uses pegged ERR as a reference since including all the three classifications will create a problem dummy variable trap. The study tested the model with six categories ERR classification of Ilzetzki et al. (2016).

Now a day's different studies reveal that in addition to macroeconomic factors institutional factors (institutional quality) are important. For example, Jackson & Miles (2008) showed that using the International Country Risk Guide (ICRG) ratings in inflation models somehow affects the significance of ERR dummies. In addition to that, the ICRG significantly affects inflation throughout their multiple specifications. Therefore, in this study, the initial IMF model was improved to include institutional factors. However, since more recent studies by Gosh (2014) and Petreski (2014) preferred the use of WGI, which is more comprehensive and freely available, the study used WGI instead of ICRG.

The second model which was estimated by fixed effect estimation was the following:

$$\text{Equation (2)} \quad \pi_{it} = \beta_0 + \beta_1 X_{it} + \alpha_1 \text{float} + \alpha_2 \text{int} + \theta_i + \gamma_t + \varepsilon_i$$

The above model (model 2) is the same as model-1 except for the inclusion of ' $\theta$ ' individual observation (country in our case) fixed effect i.e. unobserved characteristics specific to a country.

Finally, the third model to estimate the relationship between ERR and inflation was the following dynamic model

$$\text{Equation (3)} \quad \pi_{it} = \beta_0 + \beta_1 X_{it} + \delta \pi_{it-1} + \alpha_1 \text{float} + \alpha_2 \text{int} + \theta_i + \gamma_t + \varepsilon_i$$

The difference between the last model and the former (fixed effect model) is that the later includes lagged inflation as an explanatory variable for present inflation which implies that inflation is dynamic in its nature and today's inflation is partly a result of yesterday's inflation.

## **2. Growth Model**

Like the case of the inflation, the study used multiple growth models.

Initial growth model was the same model with the IMF (2016) model which is specified as follows:

$$\text{Equation (4)} Y_{it} = \beta_0 + \beta_i X_{it} + \alpha_1 \text{float} + \alpha_2 \text{int} + \gamma_t + \varepsilon_i$$

Where, ' $Y_{it}$ ' is Real GDP (GDP measured in constant prices, the base year being country specific). ' $\beta_0$ ' is the intercept. ' $X_{it}$ ' is the vector of control variables. The control variables include; Initial per capita income, Population growth (percent per year), Average years schooling (years), Terms-of-trade, Real exchange rate, Investment (percent of GDP), Inflation (percent per year), Fiscal balance (percent of GDP), Government spending (percent of GDP) and Trade openness. 'float' and 'int' are dummy variables for floating and intermediate ERR (keeping pegged category as a reference), respectively. ' $\gamma_t$ ' is a vector of year dummy and ' $\varepsilon_i$ ' is error term.

Like in the case of inflation, the study improved the basic model by including the WGI index to account for institutional factors. Among studies on the effect of ERR on economic growth studies by prominent economists like Gosh (2014), Levy-Yeyati & Sturzenegger (2003) and Petreski (2014) consider the importance of institutional variables for their estimation. Following Gosh (2014) and Petreski (2014) who used the worldwide governance indicator (WGI) data, this study used the same (WGI) to estimate the impact of institution on economic performance. The second model which is estimated by using the fixed effect estimation is as follows:

$$\text{Equation (5)} Y_{it} = \beta_0 + \beta_i X_{it} + \alpha_1 \text{peg} + \alpha_2 \text{int} + \theta_i + \gamma_t + \varepsilon_i$$

In this model, all the variables were the same except the country fixed effect is added as the FE model enables as to account for country-specific unobserved characteristics.

The final model the study used for estimation of the growth equation was a dynamic model specified below:

$$\text{Equation (6)} Y_{it} = \beta_0 + \delta Y_{it-1} + \beta_i X_{it} + \alpha_1 \text{float} + \alpha_2 \text{int} + \theta_i + \gamma_t + \varepsilon_i$$

In equation 6, the study added the lagged value of the dependent variable (lagged RGDP) as an additional explanatory variable. (Refer appendix 4 for description of variables)

## **CHAPTER 4: DATA ANALYSIS AND INTERPRETATION**

This chapter presents an analysis of the data using both the descriptive statistics and econometric analysis. The chapter is presented in two sections. The first section is an analysis of the data using descriptive statistic methods. Then the second section presents an econometric analysis of the data, which leads us to make conclusions about the relationship between explanatory and explained variables.

### **4.1 Descriptive Analysis**

Under this topic, the study analyzes the trend, mean, standard deviation and the like of ERR, Inflation and Economic growth (Real GDP/capita growth) of the selected East African countries. The section is presented in three sub-sections. In the first sub-section, the study analyze the choice of ERR across-countries and overtime. In the second sub-section, the study explained the relationship between inflation and ERR using summary tables and graphs. Finally, in the third section, the study analyzed the relationship of ERR and economic growth using graphs and tables.

All the analysis in this part is made based on the three way classification of ERR. The study used the de-jure, IMF de-facto, and Ilzetzki et al (2017) classifications in order to make a comparison. The three-way classification in this study is as Pegged, intermediate and floating. The Pegged classification includes classification as "No separate legal tender or currency union" and "Pre-announced peg or currency board arrangement". The Floating classification includes arrangement as "Free floating" while; all the remaining arrangements are classified as intermediate.

#### **4.1.1 Descriptive analysis of Exchange rate regime**

As it can easily be understood from table 2 the ERR classification of IMF is less than the de-jure classification in 73 observations. Among these observations, the maximum difference between the two is 2. This implies according to IMF some countries sometimes claim (de-jure) floating regime while actually practicing a pegged regime. On the other hand, in 96 observations according to the IMF classification, East African countries kept their word (as de-jure represents the word). Moreover, the IMF classification is greater than the de-jure

claim in 25 observations; which imply some countries sometimes practice relatively flexible regime while claiming relatively fixed regimes.

The result leads to an important finding which is the countries face fear of floating. However, according to the Ilzetzi et al. classification, there is no event that countries float declaring other arrangements but, in 97 observations they do peg while declaring intermediate regimes.

**Table 2: Comparing ERR classifications**

| Comparing ERR datasets                            | Difference |         |           |         |
|---------------------------------------------------|------------|---------|-----------|---------|
|                                                   | Count      | Minimum | average   | Maximum |
| IMF three <sup>1</sup> <Dejure three <sup>2</sup> | 73         | -2      | -1.041096 | -1      |
| IMF three=Dejure three                            | 96         |         |           |         |
| IMF three>Dejure three                            | 25         | 1       | 1         |         |
| Ilzetzi et al. <sup>3</sup> . three< Dejure three | 97         | -1      | -1        | -1      |
| Ilzetzi et al. three=Dejure three                 | 113        |         |           |         |
| IMF three < Ilzetzi et al. three                  | 7          | -1      | -1        | -1      |
| IMF three = Ilzetzi et al. three                  | 140        |         |           |         |
| IMF three >Ilzetzi et al. three                   | 47         | 1       | 1         | 1       |

The ERR classification shows that the ERRs of East African countries are concentrated in the intermediate category. However, the statistics in table 3 shows that the frequency of claim of an intermediate regime is much lower than the practice, which means many countries claim floating regime but actually run an intermediate regime. Moreover, according to the Ilzetzi et al classification, in more than 95% of observations countries in the region run an intermediate regime in reality (while it is 72% in IMF classification). Among total observations, the percentage of observations running floating regime is higher compared to those running fixed regime according to both the IMF and De-jure classifications. However, the Ilzetzi et al. classification shows opposite of that and it even shows there is no single observation with the floating regime in East Africa from 1996 to 2016. Table 3 also shows there was no claim of pegged regime in the region in the study period.

<sup>1</sup> IMF three is a categorical variable where pegged, intermediate and floating regimes are represented by 1,2 and 3 respectively in the IMF classification

<sup>2</sup> Dejure three is also categorical variable like IMF three but based on De-jure classification

<sup>3</sup> Ilzetzi et al is also the same categorical variable but based on Ilzetzi et al classification

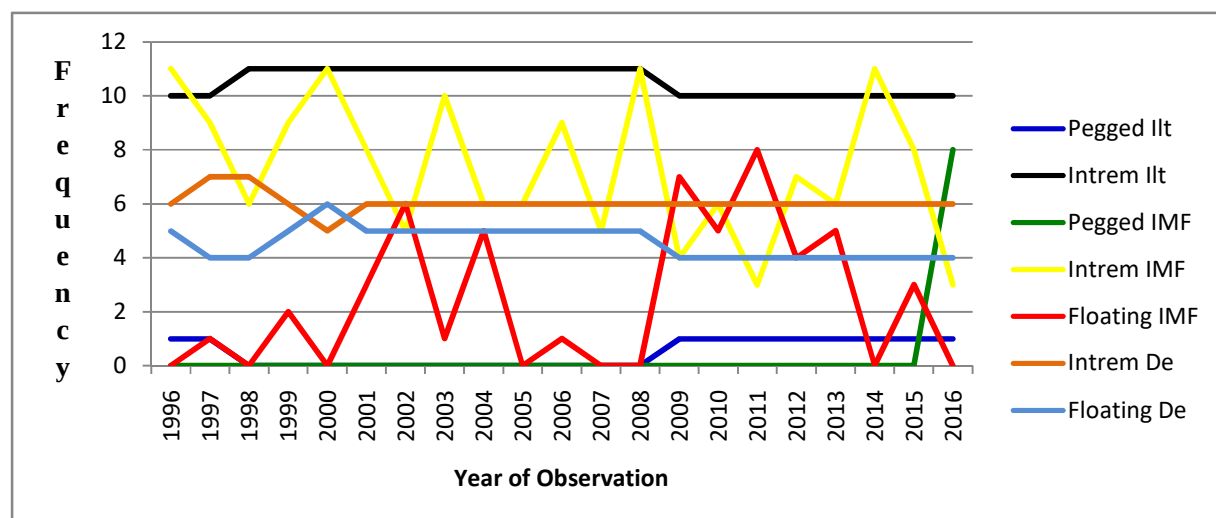
The mean and standard deviation table (table 4) shows more or less the same information with the above analysis. Table 4 shows that the De-jure classification is the most diversified classification, followed by the IMF classification, while the Ilzetzi et al. is the least diversified classification. However, the mean being around '2' (which is the code for intermediate) shows that on average our observations fall in the intermediate regime.

**Table 3: ERR category Summary**

|       | IMF Three <sup>4</sup> |         | Ilzetzi et al. Three <sup>5</sup> |         | De-Jure Three <sup>6</sup> |         |
|-------|------------------------|---------|-----------------------------------|---------|----------------------------|---------|
| Categ | Freq.                  | Percent | Freq.                             | Percent | Freq.                      | Percent |
| 1     | 7                      | 3.61    | 10                                | 4.76    | 0                          | 0       |
| 2     | 141                    | 72.68   | 200                               | 95.23   | 115                        | 54.76   |
| 3     | 46                     | 23.71   | 0                                 | 0       | 95                         | 45.24   |
| Total | 194                    | 100     | 210                               | 100     | 210                        | 100     |

**Table 4: Mean and SD of ERR category**

| Stats | IMF three | Ilzetzi three | Dejure three |
|-------|-----------|---------------|--------------|
| SD    | 0.487191  | 0.097351      | 0.4989166    |
| Mean  | 2.201878  | 1.99041       | 2.452352     |



**Figure 3: ERR classifications frequency graph (After removing Zimbabwe)**

Note: The abbreviations IMF, Ilt and De represent three way classifications of IMF, Ilzetzi et al. and De-jure, respectively.

<sup>4</sup> IMF three means the IMF de-facto classification into three categories; which are 1=Pegged ERR, 2=Intermediate and 3=floating

<sup>5</sup> Ilzetzi et al three means Ilzetzi et al. three way classification the same as in the above note.

<sup>6</sup> De-Jure three also represents the same three way classification, but of the De-jure arrangements

Figure 4 show that the IMF classification is the most diversified classification. According to the IMF classification, most of the observations fall into intermediate and floating regimes both having high volatility overtime. East African countries according to the other classifications did not significantly change their ERR over the period of study.

The number of countries declaring intermediate regime was on average six with a little volatility in the years from 1996 to 2001. Even though the de-jure classification is the most stable one in general, the floating regime is the relatively volatile in this category indicating that countries claiming flexible (floating) regime change their regime for reasons that the study would figure out in the next parts.

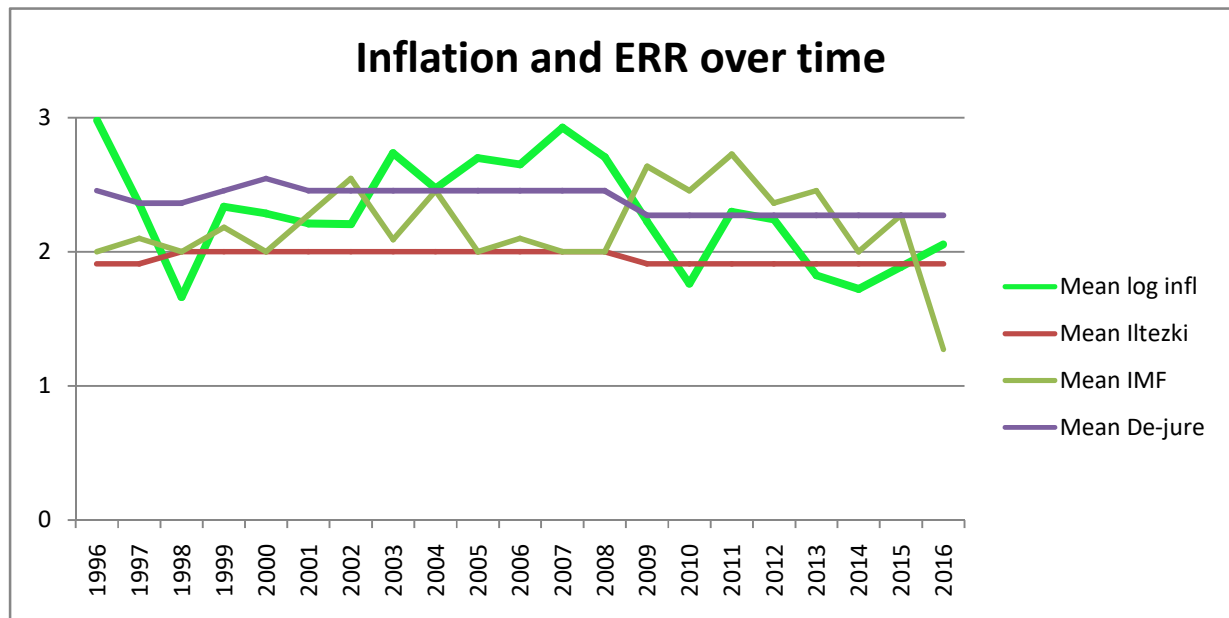
Finally, the Ilzetzki et al classification is the least diversified classification. In this classification the intermediate regime was dominant throughout the period. This implies that as per this classification, the regime of countries in the study is similar and stable over time.

#### **4.1.2 Descriptive analysis of the relationship between inflation and Exchange Rate Regime**

Looking at figure 5 of inflation in East Africa overtime (from 1996-2016), it can be said that inflation in East Africa was volatile. Inflation in 1996, 1999, 2003, 2007 and 2011 are the relative peaks of inflation in the region on average. On the other hand, the years 1998, 2004, 2010 and 2014 are the years with the relative bottom of inflation in the study area on average. Generally, the highest average inflation is recorded in 1996 and 2007; the lowest being in 1998.

As shown on figure 5 the movement in inflation over time do not seem to have anything to do with ERR with the exception of ERR classification based on IMF de-facto arrangement. In the IMF classification the reduction of inflation in East Africa in the years 1998, 2010 and 2014 seem to be correlated with the movement in ERR towards more Pegged regimes. In the same fashion, the rise in inflation in 1999 and 2011 seems correlated with the movement in ERR towards more flexible regimes. These results are in line with the argument that flexible regimes are more inflationary while fixed regimes are inflation averse. However, the above analysis did not work for the whole years of analysis. For example, the rise in inflation in

2003 and 2016 are correlated with movement to a fixed regime (which is opposite to the above argument).

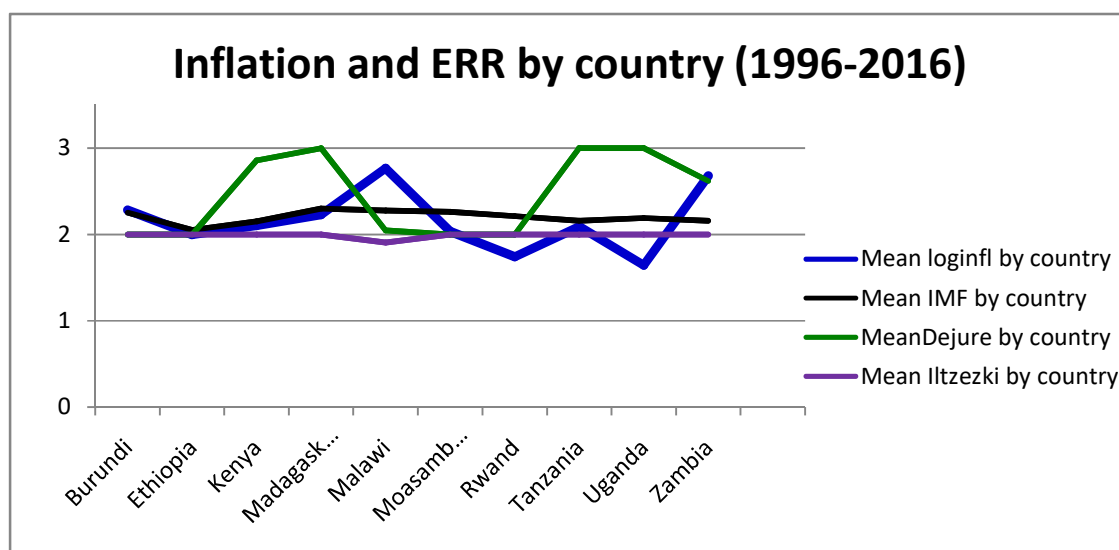


**Figure 4: Inflation and ERR over time**

**Note: for inflation the study is using Log of inflation which means it is ignoring the negative inflation.**

According to figure 6 relatively highest levels of inflation is recorded in Malawi and Zambia. On the other hand, Ethiopia, Rwanda, and Uganda had relatively low inflations among the sample countries. Among them, Uganda had the lowest inflation.

The same with the above cases, according to figure 6 inflation does not look like correlated with ERR except in the de-jure classification. Even in the de-jure case, the choice of ERR does not seem to have a uniform impact on inflation between countries. Though early to conclude, the floating (flexible) regime is correlated with lower inflation in Uganda while higher inflation is correlated with intermediate in Malawi. The result al implies that there is significant difference of claim of ERRs between our sample countries. However, the actual (de-facto) difference is very small. Nevertheless, according to figure-4 there is significant variation over time according to de-facto classification of IMF.



**Figure 5: Inflation and ERR by country (Average of the data from 1996-2016)**

**Note:** the inflation data were using is logarithm of inflation which removes negative values.

The correlation table (table 5) shows that inflation is weakly but negatively correlated with ERR in East Africa; this implies movement towards more flexible regimes is related to lower inflation. According to the results in the tables ERR using Ilzetzi et al classification is the most correlated classification; while the de-jure classification is the least correlated with inflation. The result implies that even if the value is very small claim of ERRs is related to inflation.

The results here say nothing about the causality but they are saying that the relationship between inflation and ERR is weak and depends on the choice of ERR data. Moreover, the results show that the correlation between inflation and ERR depends on the type of classification used which, supports our decision to use different classifications and make sure that the results are not biased due to the choice of data.

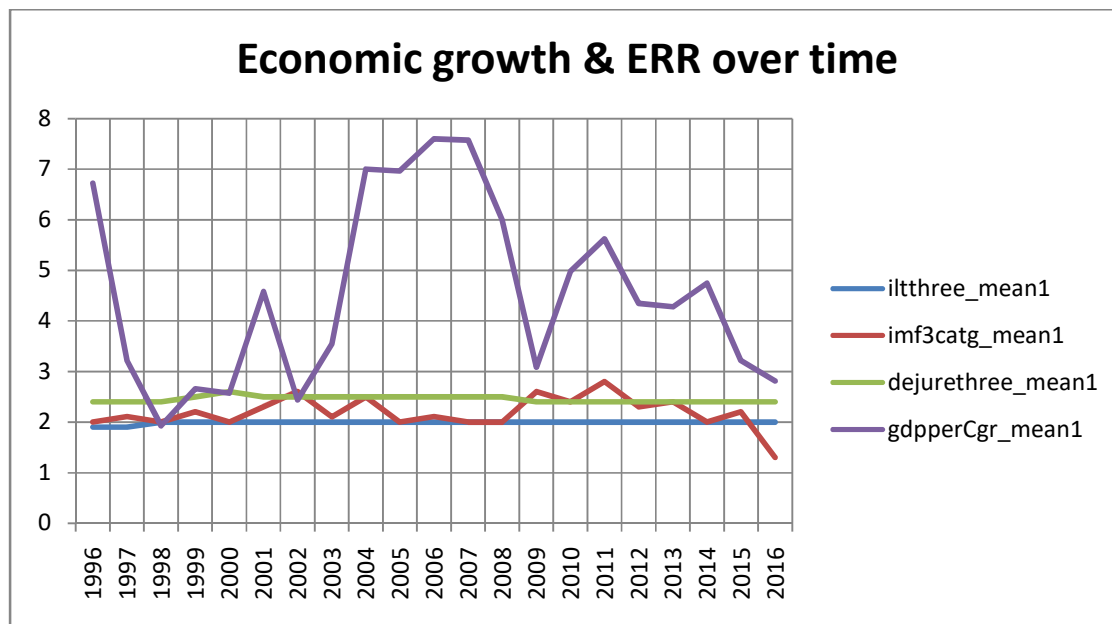
**Table 5: Correlation table**

| Correlation table |           |               |           |           |           |
|-------------------|-----------|---------------|-----------|-----------|-----------|
|                   | Inflation | Ilzetzi three |           | Inflation | IMF three |
| Inflation         | 1         |               | Inflation | 1         |           |
| Ilzetzi three     | -0.1429   | 1             | IMF three | -0.0477   | 1         |
|                   | Inflation | Dejure three  |           |           |           |
| Inflation         | 1         |               |           |           |           |
| Dejure three      | -0.0157   | 1             |           |           |           |

#### 4.1.3 Descriptive analysis of the relationship between Economic Growth and Exchange Rate Regime

According to figure 7, East African countries on average had better economic growth in 1996, 2001, from 2004-2008, 2011 and 2014. On the other hand, years 1998, 2002, 2009 and 2016 are years of relative a trough. According to the data, the period from 2004 to 2008 was the best period for the region; while 1998-99 was the worst.

**Figure 6: Economic Growth and ERR overtime**



According to the figure the movement of economic growth in the region cannot be correlated with ERR classifications of Ilzetzi et al and de-jure classifications. According to the two classifications, the ERR in the region had a very little variation, while the growth showed high volatility. The graph also shows no clear correlation between the IMF classification and growth. However, looking at the pattern the relationship seems more positive.

Figure 8 shows that in the period of study Mozambique, Rwanda and Ethiopia had better level of economic growth on average. The highest average growth level was that of Mozambique (7.49%) followed by Ethiopia (7.11%). The lowest average economic growth rate was that of Burundi, followed by Madagascar.

The relationship between ERR and Economic growth country wise can only be explained using the de-jure classification only. According to the graph countries with intermediate regime on average performed better than those with flexible regime on average.

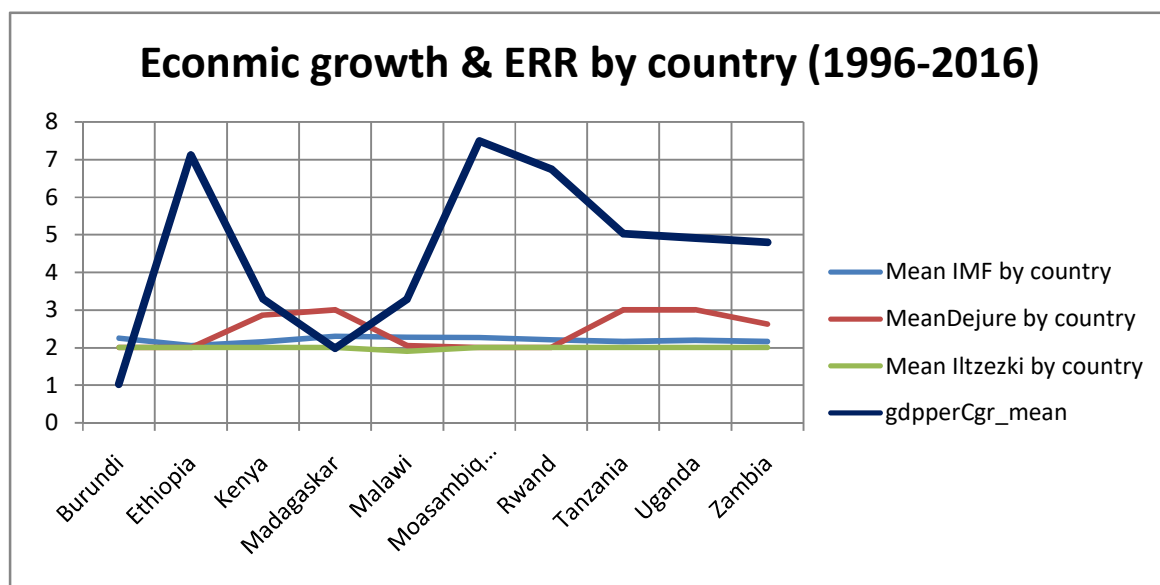


Figure 7: Economic growth and ERR by Country (Average data from 1996-2016)

## 4.2 Econometric Analysis

In this section the study presents deeper analysis of the data using panel econometric approaches. The section is presented in two major sub-sections. The first sub-section presents the econometric analysis which answers the question "does the exchange rate regime matter for inflation in East African countries?". The second sub-section answers the question "does the exchange rate regime matter for economic growth of East African countries?". As explained in chapter one inflation and economic growth are our selected macroeconomic performance indicators to see whether ERR choice matter for economic performance or not.

#### 4.2.1 Econometric Analysis of the Inflation Models

In this part the study analyzes the relationship between inflation and ERR using a range of models. The part has different sub-sections. The first sub-section present and analyzes a range of inflation models. The second sub-section presents different data and model specification tests (diagnostics). Finally, the third part present the analysis based on the modified data and models according to the results of tests in part two.

##### 4.2.1.1 Estimation of Inflation Models

Under this topic the study presented extensive analysis of association of inflation and ERR in East African countries. The study initially starts with a basic model including ERR as explanatory variable for inflation measured by consumer price index (CPI). Then, the model is improved to consider year (time) specific effects i.e. effect of time. Then after, the model is extended further to control for different factors affecting inflation overtime. Finally, the model is extended again to include institutional quality measured by WGI. The study considered the WGI in two ways, which are the average institutional quality index and the extended measure of institutional quality which has six elements (corruption index, effectiveness index, stability index, regulatory quality index, rule of law index and Accountability index).

###### 4.2.1.1.1 Estimation of the Basic Inflation Model

The basic inflation regression model ignores the possible effect of other variables and year dummies. The model is estimated using different estimation techniques which are pooled OLS, fixed effects and random effects estimation techniques. This is done because previous studies reviewed in the literature review chapter show contradicting results; which is assumed could be partly due to the difference in the estimation technique they applied. The study also tried to solve the difference in results due to ERR classification datasets.

**Table 6: Estimation of the basic inflation model**

| <b>Regression without year dummies nor control variables</b> |                   |               |                |
|--------------------------------------------------------------|-------------------|---------------|----------------|
| Variable                                                     | Pooled Regression | Fixed Effects | Random Effects |

|                            |            |             |                         |
|----------------------------|------------|-------------|-------------------------|
| imfthree2 <sup>7</sup>     | 5.400984   | 3.909975    | 4.2367411               |
| imfthree3 <sup>8</sup>     | 3.816647   | 1.861748    | 2.290539                |
| dejurethree2 <sup>9</sup>  | .2751707   | -8.709282** | -3.442441 <sup>10</sup> |
| dejurethree3 <sup>11</sup> | Omitted    | Omitted     | omitted                 |
| iltthree2 <sup>12</sup>    | -12.65714* | -5.241522   | -7.94273                |
| legend:                    | * p<0.05;  | **p<0.01;   | ***p<0.001              |

Table 6 shows that when the inflation model is estimated using pooled OLS the choice of ERR has no impact except when using the ERR dataset of Ilzetzi et al. The Fixed effect estimation supports the OLS. In the fixed effect model, like in the OLS, an intermediate regime is negatively related to inflation. However, in the fixed effect the significant regime classification is only the de-jure classification, while it is that of Ilzetzi et al in the pooled regression. Finally, the random effects estimation shows no significance of ERR, regardless of the type of classification.

Nevertheless, the result could be over or understated due to different factors like the effect of time (trend effect) or the ignorance of factor other than ERR affecting inflation. Moreover, the result should be interpreted with a great caution as different diagnostic tests were not performed. Finally, note that the study ignored interpreting the value in the coefficient as it causes inflation to change by that magnitude because econometricians today almost agree that regression does not show causality rather dependency.

#### 4.2.1.1.2 Estimation of the inflation Model Controlling the Time Effect

**Table 7: Estimates of regressions with year dummies**

|           | Pooled Reg | RE     | FE     | Pooled | RE   | FE   | Pooled | RE   | FE   |
|-----------|------------|--------|--------|--------|------|------|--------|------|------|
|           | Infl       | Infl   | Infl   | Infl   | Infl | Infl | Infl   | Infl | Infl |
| imfthree2 | 7.706      | 6.619  | 6.558  |        |      |      |        |      |      |
|           | (0.97)     | (0.92) | (0.89) |        |      |      |        |      |      |
| imfthree3 | 7.455      | 5.907  | 5.814  |        |      |      |        |      |      |

<sup>7</sup>IMFthree2 is an abbreviation for the intermediate regime in the three way IMF arrangement of ERR

<sup>8</sup>IMFthree3 represents the floating regime in the three way IMF arrangement

<sup>9</sup> It stands for intermediate in the de-jure three way arrangement

<sup>10</sup> Significant at 10%

<sup>11</sup>For floating in the de-jure three way arrangement

<sup>12</sup>It represents the intermediate regime in the Ilzetzi et al. three way arrangement.

We included only the intermediate dummy in the Ilzetzi et al. because we do not have any floating regime in the sample.

|              |        |        |        |          |         |          |         |         |        |
|--------------|--------|--------|--------|----------|---------|----------|---------|---------|--------|
|              | (0.92) | (0.8)  | (0.77) |          |         |          |         |         |        |
| dejurethree2 |        |        |        | 0.364    | -2.518  | Omitted  |         |         |        |
|              |        |        |        | (0.3)    | (-1.39) | (.)      |         |         |        |
| dejurethree3 |        |        |        | Omitted  | omitted | 9.314*** |         |         |        |
|              |        |        |        | (.)      | (.)     | (3.38)   |         |         |        |
| iltthree2    |        |        |        |          |         |          | -7.195  | -1.093  | 1.596  |
|              |        |        |        |          |         |          | (-1.14) | (-0.18) | (0.26) |
| year1        | 10.85* | 7.044  | 10.80* | 8.222*   | 11.26** | 11.69**  | 10.48** | 11.16*  | 11.04* |
|              | (2.29) | (1.16) | (2.48) | (2.16)   | (2.64)  | (2.83)   | (2.73)  | (2.57)  | (2.57) |
| year13       | 7.045  | 3.234  | 6.989  | 4.449    | 7.199   | 6.945    | 7.391   | 7.462   | 7.068  |
|              | (1.48) | (0.53) | (1.61) | (1.17)   | (1.69)  | (1.68)   | (1.95)  | (1.73)  | (1.66) |
| _cons        | 2.572  | 7.469  | 3.645  | 12.69*** | 11.38** | 5.754    | 17.13*  | 10.95   | 8.626  |
|              | (0.29) | (1.46) | (0.45) | (4.65)   | (3.02)  | (1.59)   | (2.5)   | (1.56)  | (1.24) |
| N            | 189    | 189    | 189    | 205      | 205     | 205      | 205     | 205     | 205    |

Note: the regressions are made separately but the year and regime dummies are merged in one table to make it easily understandable.

Table 7 shows that the ERR does not significantly affect inflation except when using the de-jure classification. The result means that it is only the claim of ERR affecting inflation in East Africa. The coefficient of de-jurethree3 (floating regime) is positively significant only in the fixed effect estimation. This implies that having a floating regime is related to 9.3% higher inflation. The finding here (controlling for time fixed effects) is somehow consistent with the regression in table-7, i.e. in table-7 regression, the study found the claim of an intermediate regime is related to reduced inflation.

Among the year dummies, the 1<sup>st</sup> year dummy (the year 1996) is positively significant in all estimations regardless of the type of data and estimation technique (except FE with IMF data). In addition to the 1st year, the 13th year (2008) is positively significant at 10% degree of freedom in most of the specifications..

#### 4.2.1.1.3 Estimation of the inflation model controlling for both year effects and other explanatory variables

**Table 8: Estimates of inflation model with control variables and year dummies**

|           | Pooled | FE     | RE    | Pooled | FE   | RE   | Pooled<br>FB | Pooled<br>no FB | FE<br>FB | FE no<br>FB | RE<br>FB | RE no<br>FB |
|-----------|--------|--------|-------|--------|------|------|--------------|-----------------|----------|-------------|----------|-------------|
|           | Infl   | Infl   | Infl  | Infl   | Infl | Infl | Infl         | Infl            | Infl     | Infl        | Infl     | Infl        |
| imfthre2  | 10.54  | 12.69  | 10.54 |        |      |      |              |                 |          |             |          |             |
|           | (1.4)  | (1.71) | (1.4) |        |      |      |              |                 |          |             |          |             |
| imfthree3 | 11.27  | 12.6   | 11.27 |        |      |      |              |                 |          |             |          |             |

|              |          |          |           |          |           |           |          |         |         |          |         |          |
|--------------|----------|----------|-----------|----------|-----------|-----------|----------|---------|---------|----------|---------|----------|
|              | (1.48)   | (1.67)   | (1.48)    |          |           |           |          |         |         |          |         |          |
| dejurethree2 |          |          |           | -0.142   | -8.814*** | -0.142    |          |         |         |          |         |          |
|              |          |          |           | (-0.14)  | (-3.58)   | (-0.14)   |          |         |         |          |         |          |
| dejurethree3 |          |          |           | omitted  | omitted   | Omitted   |          |         |         |          |         |          |
|              |          |          |           | (.)      | (.)       | (.)       |          |         |         |          |         |          |
| iltthree2    |          |          |           |          |           |           | 0        | -4.649  | 0       | 4.721    | 0       | -4.649   |
|              |          |          |           |          |           |           | (.)      | (-0.86) | (.)     | -0.9     | (.)     | (-0.86)  |
| BMgrowth     | 0.00013* | 0.000105 | 0.000128* | 0.00013* | 5.76E-05  | 0.000128* | 0.00013* | 0.00011 | 9.9E-05 | 3.32E-05 | 0.0001* | 0.00011  |
|              | (2.05)   | (1.69)   | (2.05)    | (2.12)   | (0.98)    | (2.12)    | (2.14)   | (1.54)  | (1.65)  | (1.27)   | (2.14)  | (1.54)   |
| RGDPPER      | -0.0493  | 0.157    | -0.0493   | -0.0708  | 0.0911    | -0.0708   | -0.0731  | -0.241  | 0.103   | 0.0495   | -0.073  | -0.241   |
|              | (-0.33)  | (0.9)    | (-0.33)   | (-0.50)  | (0.57)    | (-0.50)   | (-0.52)  | (-1.55) | (0.62)  | (0.28)   | (-0.52) | (-1.55)  |
| tradeGDP     | 0.0199   | 0.017    | 0.0199    | 0.0386   | 0.083     | 0.0386    | 0.0391   | 0.083*  | 0.05    | 0.137*   | 0.039   | 0.083*   |
|              | (0.58)   | (0.29)   | (0.58)    | (1.22)   | (1.58)    | (1.22)    | (1.25)   | (2.32)  | (0.93)  | (2.44)   | (1.25)  | (2.32)   |
| CBIGAR       | -5.499   | 17.38    | -5.499    | -4.752   | 13.86     | -4.752    | -4.61    | -6.144  | 12.25   | 18.56    | -4.61   | -6.144   |
|              | (-1.77)  | (0.97)   | (-1.77)   | (-1.53)  | (0.88)    | (-1.53)   | (-1.59)  | (-1.84) | (0.75)  | (1.04)   | (-1.59) | (-1.84)  |
| FB           | -0.173   | -0.0319  | -0.173    | -0.158   | -0.0901   | -0.158    | -0.154   |         | -0.041  |          | -0.154  |          |
|              | (-0.99)  | (-0.17)  | (-0.99)   | (-0.92)  | (-0.50)   | (-0.92)   | (-0.91)  |         | (-0.22) |          | (-0.91) |          |
| TOTCHANG     | -0.0228  | -0.0415  | -0.0228   | -0.020   | -0.0427   | -0.0204   | -0.0202  | -0.019  | -0.034  | -0.030   | -0.020  | -0.0189  |
|              | (-0.74)  | (-1.32)  | (-0.74)   | (-0.68)  | (-1.48)   | (-0.68)   | (-0.68)  | (-0.55) | (-1.12) | (-0.93)  | (-0.68) | (-0.55)  |
| _cons        | 15.72    | 1.31     | 15.72     | 25.3***  | 19.20*    | 25.30***  | 25.1***  | 28.8*** | 15.59   | 3.897    | 25.2*** | 28.79*** |
|              | (1.9)    | (0.11)   | (1.9)     | (6.15)   | (2.17)    | (6.15)    | (6.38)   | (4.62)  | (1.7)   | (0.35)   | (6.38)  | (4.62)   |
| N            | 160      | 160      | 160       | 172      | 172       | 172       | 172      | 179     | 172     | 179      | 172     | 179      |

*Note: All the regressions in the table control for year dummies*

After including the control variables the ERR based on IMF de-facto classifications remained insignificant under all estimation techniques. The result is interesting in that it partially explains the difference in the results of previous studies. So, if somebody uses the IMF dataset it will lead him/her to conclude that ERR does not matter for inflation performance of East African countries. The same is true with the Ilzetzi et al classification.

The result of table 8 estimation is more or less consistent with the estimations under table 6 and 7. In the estimation, the coefficient of the de-jure intermediate regime is negative and significant. This implies a claim of an intermediate regime is associated with lower inflation.

The finding as can be seen from table 8 also shows that de-facto ERR of Ilzetzi et al is perfectly correlated with the fiscal balance (FB). This result is also interesting in that, it tells that the significance of ERR to influence inflation performance depends on whether the government fiscal policy (measured by FB) is considered.

Regarding the control variables, all control variables are insignificant in the fixed effects estimation. The result could mean that nothing except the declaration of an intermediate regime and other country fixed effects (not included on the table) were significant with regard to the difference in inflation within a country. With the exception of the BM (at 5% degree of freedom) and central bank independence (CBI) (at 10%) index by Garriga the control variables are insignificant in the pooled regressions too. The growth of broad money supply is significant also in the random effect estimation. However, in estimations with Ilzetzi et al data the significance of BM shifts to trade balance percentage of GDP (i.e. trade openness).

In all of our specifications and estimation techniques, the year dummies are significant and negative, except the year 2016 which is insignificant when the IMF ERR dataset is used. This implies all years from 1997 to 2016 are negatively associated with inflation compared to the year 1996.

Overall, our models are good as the  $R^2$ s are around 0.5, which means the models explain around 50% of the volatility in inflation in the study area. The "chi<sup>2</sup>" probability also shows the model is significant at all conventional levels. On the other hand, the F-test shows that the country fixed effects are present. However, it is early to decide which estimation technique is better as performing at least the Hausman test is needed.

#### 4.2.1.1.4 Estimation of the Inflation Model controlling Institutional Quality

Table 9 tells more or less the same story with table 9s regression which excludes the institutional quality. In table 9 as in the previous regressions (table 6-8) de-jure intermediate regime negative and significantly affect inflation in the fixed effect regression. The de-facto intermediate regime of Ilzetzi et al is also found negatively significant but in the pooled and random effect regressions. The results imply that both the claim and practice of intermediate regimes are related to lower inflation compared to the pegged ERRs (as there is no floating regime in Ilzetzi and it is omitted in the de-jure). The IMF de-facto classification is insignificant in all estimation techniques. In the estimation with Ilzetzi data, the fiscal balance is omitted due to co-linearity, as in table-8.

Among the exceptions is the removal of the significance of CBI. This might imply CBI is insignificant to inflation performance once IQ is considered. The other exception is that year

dummies of 1997, 1999 and 2001 are automatically omitted due to co-linearity (linear correlation) with institutional quality. This finding could be because the data for WGI (which is the IQ indicator used) is missing for 1997, 1999 and 2001 for all countries (removed from the table for convenience). However, all the remaining year dummies (except year 21 in regression with IMF data) are negatively significant, as in table-8.

**Table 9: Estimation of the inflation model considering institutional quality**

|              | Pooled   | FE       | RE       | Pooled  | FE       | RE      | Pooled   | FE      | RE       |
|--------------|----------|----------|----------|---------|----------|---------|----------|---------|----------|
|              | Infl     | Infl     | Infl     | Infl    | Infl     | Infl    | Infl     | Infl    | Infl     |
| imfthree2    | 8.49     | 9.378    | 8.49     |         |          |         |          |         |          |
|              | (1.13)   | (1.22)   | (1.13)   |         |          |         |          |         |          |
| imfthree3    | 9.692    | 9.829    | 9.692    |         |          |         |          |         |          |
|              | (1.27)   | (1.25)   | (1.27)   |         |          |         |          |         |          |
| iltthree2    |          |          |          |         |          |         | -14.09*  | -4.281  | -14.09*  |
|              |          |          |          |         |          |         | (-2.02)  | (-0.59) | (-2.02)  |
| dejurethree2 |          |          |          | -1.126  | -9.089** | -1.126  |          |         |          |
|              |          |          |          | (-0.56) | (-3.21)  | (-0.56) |          |         |          |
| dejurethree3 |          |          |          | 0       | 0        | 0       |          |         |          |
|              |          |          |          | (.)     | (.)      | (.)     |          |         |          |
| BMgrowth     | -0.0472  | -0.0635  | -0.0472  | -0.0461 | -0.0507  | -0.0461 | -0.0062  | -0.049  | -0.0062  |
|              | (-1.18)  | (-1.54)  | (-1.18)  | (-1.16) | (-1.32)  | (-1.16) | (-0.16)  | (-1.21) | (-0.16)  |
| RGDPperC     | 0.137    | 0.119    | 0.137    | 0.0771  | 0.0427   | 0.0771  | -0.0341  | -0.0184 | -0.0341  |
|              | (0.8)    | (0.64)   | (0.8)    | (0.48)  | (0.25)   | (0.48)  | (-0.20)  | (-0.10) | (-0.20)  |
| Tradegdp     | -0.00132 | -0.00777 | -0.00132 | 0.0338  | 0.0736   | 0.0338  | 0.0463   | 0.0702  | 0.0463   |
|              | (-0.03)  | (-0.12)  | (-0.03)  | (0.74)  | (1.29)   | (0.74)  | (0.96)   | (1.2)   | (0.96)   |
| CBlgar       | -5.423   | 24.65    | -5.423   | -5.747  | 21       | -5.747  | -3.811   | 13.81   | -3.811   |
|              | (-1.39)  | -0.93    | (-1.39)  | (-1.20) | -0.91    | (-1.20) | (-0.99)  | -0.56   | (-0.99)  |
| FB           | 0.152    | 0.133    | 0.152    | 0.0856  | 0.00957  | 0.0856  |          |         |          |
|              | (0.73)   | (0.61)   | (0.73)   | (0.42)  | (0.05)   | (0.42)  |          |         |          |
| TOTchang     | -0.0557  | -0.0545  | -0.0557  | -0.0428 | -0.0488  | -0.0428 | -0.0487  | -0.0403 | -0.0487  |
|              | (-1.60)  | (-1.51)  | (-1.60)  | (-1.29) | (-1.48)  | (-1.29) | (-1.40)  | (-1.17) | (-1.40)  |
| corrE        | 2.324    | 0.313    | 2.324    | 1.129   | -0.875   | 1.129   | 1.721    | -0.129  | 1.721    |
|              | (0.85)   | (0.09)   | (0.85)   | (0.44)  | (-0.26)  | (0.44)  | (0.68)   | (-0.04) | -0.68    |
| effecE       | -2.937   | -1.981   | -2.937   | -1.188  | 3.795    | -1.188  | -0.0274  | 2.933   | -0.0274  |
|              | (-0.84)  | (-0.42)  | (-0.84)  | (-0.35) | (0.89)   | (-0.35) | (-0.01)  | (0.66)  | (-0.01)  |
| stabilityE   | -1.445   | -3.63    | -1.445   | -0.709  | -1.586   | -0.709  | -1.218   | -2.713  | -1.218   |
|              | (-0.83)  | (-1.52)  | (-0.83)  | (-0.42) | (-0.72)  | (-0.42) | (-0.77)  | (-1.20) | (-0.77)  |
| RegQE        | -6.128*  | -1.544   | -6.128*  | -7.053* | -3.039   | -7.053* | -7.030** | -1.406  | -7.030** |
|              | (-2.23)  | (-0.37)  | (-2.23)  | (-2.28) | (-0.80)  | (-2.28) | (-2.69)  | (-0.38) | (-2.69)  |
| ROLE         | 3.264    | 3.228    | 3.264    | 3.847   | -0.0334  | 3.847   | 3.533    | -1.653  | 3.533    |
|              | (1.06)   | (0.54)   | (1.06)   | (1.31)  | (-0.01)  | (1.31)  | (1.17)   | (-0.31) | (1.17)   |

|         |        |        |        |          |        |          |          |        |          |
|---------|--------|--------|--------|----------|--------|----------|----------|--------|----------|
| accounE | 4.997* | 8.211  | 4.997* | 2.456    | 4.132  | 2.456    | 4.169    | 7.797* | 4.169    |
|         | (2.01) | (1.78) | (2.01) | (0.9)    | (1.06) | (0.9)    | (1.9)    | (2.05) | (1.9)    |
| _cons   | 18.81* | 8.054  | 18.81* | 25.73*** | 19.87  | 25.73*** | 36.93*** | 21.87  | 36.93*** |
|         | (2.16) | (0.49) | (2.16) | (4.7)    | (1.57) | (4.7)    | (4.72)   | (1.53) | (4.72)   |
| N       | 138    | 138    | 138    | 150      | 150    | 150      | 154      | 154    | 154      |

In regression with WGI (average), the indicator is insignificant but, using the extended form of WGI the index of regulatory quality of government become significantly negative regardless of the type of ERR datasets using the pooled OLS and Random effects estimation techniques. In addition to this, the index of voice and accountability also become significantly positive for inflation but only when using the IMF ERR dataset in all estimation techniques at least at 10% degree of freedom. The interpretation of the regulatory quality is simple. It implies that better regulatory quality is associated with reduced inflation. It could also mean that the difference in regulatory quality is among the reasons for the difference in inflation performance between East African countries. The interpretation of the voice and accountability index is a little more complex. It could mean that higher voice and accountability is associated with higher inflation. This is interesting but not against logic and economic theory because, when the government is more transparent about the situation in the country it could increase the public expectation of inflation in bad times<sup>13</sup>.

The Chi<sup>2</sup> probability shows that (not displayed) the model is good and overall significant at all conventional statistical levels including at 99.9% confidence interval.

#### ***4.2.1.2 Tests of Data and Model Specifications of the Inflation Models***

##### ***4.2.1.2.1 Heteroscedasticity Test***

The study performed the modified Wald test to check for the presence of heterogeneity. The modified Wald test tests the null hypothesis that the error terms are homogeneous.

The test results show that all our models are heteroscedastic, i.e. the null hypothesis is rejected at all conventional levels including at 1% degree of freedom. Given the presence of cross-section component (due to the presence of 10 observations (countries) at time T for

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<sup>13</sup> Expectation is among the major determinants of inflation because when people expect general prices to rise then their current demand increase which creates competition among buyers. This leads to shortage and therefore, inflation

each variable) the presence of Heteroscedasticity is expected. We can control for the problem either by using the option 'robust' or 'cluster (..)'. (refer to Appendix 2)

#### 4.2.1.2.2 Test of time fixed effect

Even though the study initially estimated its models both with and without year dummies and found at least some of the year dummies to be significant, it is found important to check for overall significance of the year dummies. The test for time effects the study used is 'test parm'. The null hypothesis for this test is that all the dummies are jointly statistically equal to zero. Our test results rejected the null hypothesis even at the smallest degree of freedom (1%), showing that the time effect is important for our estimation and the year dummies are statistically different from zero (Appendix 3).

#### 4.2.1.2.3 Testing for Random Effects

Breusch-Pagan Lagrange multiplier (LM) test helps us decide between the random effects and pooled OLS regressions. The null hypothesis in this test assumes the variance across entities to be zero (i.e. there is no panel effect). In other words, the null hypothesis assumes pooled OLS and Random effect are statistically equal; and OLS is efficient. As you can see from table 10 the study failed to reject the null hypothesis in all data types. Therefore, the test result leads as for conclusion that random effect is not appropriate.

**Table 10: Breusch-Pagan Lagrange multiplier (LM)**

Infl[sno,t] = Xb + u[sno] + e[sno,t]

|                    |  |  |               |                |
|--------------------|--|--|---------------|----------------|
| Estimated results: |  |  | With IMF data |                |
|                    |  |  | Var           | sd = sqrt(Var) |
| Infl               |  |  | 48.3647       | 6.954473       |
| e                  |  |  | 35.51389      | 5.959353       |
| u                  |  |  | 0             | 0              |

Test: Var(u) = 0

chibar2(01) = 0.00  
Prob > chibar2 = 1.0000

|                    |  |  |                   |                |
|--------------------|--|--|-------------------|----------------|
| Estimated results: |  |  | With De-jure data |                |
|                    |  |  | Var               | sd = sqrt(Var) |
| Infl               |  |  | 46.24528          | 6.800389       |
| e                  |  |  | 41.36569          | 6.431617       |
| u                  |  |  | 1.47374           | 1.213977       |

Test: Var(u) = 0

chibar2(01) = 1.28  
Prob > chibar2 = 0.1293

|                    |  |  |                          |                |
|--------------------|--|--|--------------------------|----------------|
| Estimated results: |  |  | With Ilzetzki et al data |                |
|                    |  |  | Var                      | sd = sqrt(Var) |
| Infl               |  |  | 46.24528                 | 6.800389       |
| e                  |  |  | 42.28524                 | 6.50271        |
| u                  |  |  | 1.292095                 | 1.136704       |

Test: Var(u) = 0

chibar2(01) = 1.20  
Prob > chibar2 = 0.1368

#### 4.2.1.2.4 Testing Fixed effect Vs Pooled OLS

The choice between fixed effect and pooled OLS regression models depends on the F-test. It tests whether the unobserved individual fixed effects are statistically equal to zero or not. The null hypothesis of the test is that it is equal to zero. Performing a separate F-test is not needed as stata provides the result with the results of the fixed effect regression. In our case in all our models throughout this paper, the F-test shows the individual fixed effects are statistically different from zero (i.e. reject the null hypothesis). Therefore, the fixed effect is always better than OLS in all the models and specifications in this paper.

#### 4.2.1.2.5 Hausman Test

The study performed a Hausman test to choose between random effect and fixed effect models. It tests the null hypotheses that difference in coefficients is not significant (i.e., both FE and RE are consistent under Ho, while RE is more efficient).

The test in our case shows different results for models with different ERR datasets. The test result rejects the null hypothesis only for estimation with IMF regime data. In the other two estimations (i.e. estimations with de-jure and Ilzetzi et al three-way regime classifications) the study failed to reject the null and conclude that RE models are better (refer Appendix 4). However since ' $\beta$ ' is not positive definite the test is not reliable.

#### 4.2.1.2.6 Implication of the Tests and Their Remedies

Our first test which is the Heteroscedasticity test shows the presence of Heteroscedasticity problem in our estimations. Even though some economists allow the unobserved individual fixed effect to be heteroscedastic, the best solution suggested by most economists on 'statalist'(stata forum) is to use the option 'robust' or 'cluster (...)'.  
'

Our second test, a test of time fixed effect, suggests the study should include the time (year) dummies in our estimations.

The remaining three tests are interrelated. The first among them suggests pooled OLS is better than a random effect. The second suggests that fixed effect is better than the OLS regression. Whereas, the last test suggests fixed effect regression only for estimation with IMF ERR datasets. However, econometricians suggest taking the suggestion of the LM test whenever the results of the LM and Hausman test results seem to contradict. More importantly, the covariance matrix of the coefficients is not positive definite which is a common problem in Hausman test making its result biased (Verbeek M. 2012).

Therefore, the study used fixed effect estimation with robust data including time effects in the final estimation of the inflation model.

#### 4.2.1.3 *Final Estimation of the inflation model*

Based on what the tests in the preceding part suggest in this part the study made an estimation based on the FE adjusted for both Heteroscedasticity and serial autocorrelation i.e. clustering the observations using the individual countries.

Among the ERR classification datasets, the study chosen the Ilzetzi et al dataset. The dataset is selected because of different reasons. First, the study found in the previous parts (section 4.2.1.1) that ERR based on the IMF datasets are of no importance for both inflation

and economic growth. Second, the de-jure data set even though, it shows claim of the intermediate regime was negative for inflation in the previous part (section 4.2.1.1); it has no much-extended classification. It is also insignificant when checked after controlling Heteroscedasticity. Finally, the Ilzetzki et al dataset is with extended classifications (coarse with six classifications and fine with 14 classifications). Moreover, its significance was the best in all estimations conducted before. Last, but not least, most researchers on the topic including the co-outers Reinhart and Rogoff, Gosh, Bohl and so on used this regime classification dataset.

In this part, the study also included estimation of the model using the system GMM (Arellano Bover/BlundellBond) estimation. The method is used for two reasons. The first is to include a dynamic nature of economic activities. Second, because it controls for endogeneity by generating its own instrument (i.e. it has a future of IV without the need of finding instruments).

Table 11 shows an estimation of inflation model using two types of ERR classifications of the Ilzetzki et al dataset. The first type of classification is classification into extended "fine" classifications, which have fifteen categories listed below:

1. No separate legal tender or currency union
2. Pre announced peg or currency board
3. Pre announced horizontal band  $\leq \pm 2\%$
4. De facto peg
5. Pre announced crawling peg; de facto moving band  $\leq \pm 1\%$
6. Pre announced crawling band  $\leq \pm 2\%$  or de facto horizontal band  $\leq \pm 2\%$
7. De facto crawling peg
8. De facto crawling band  $\leq \pm 2\%$
9. Pre announced crawling band  $\geq \pm 2\%$
10. De facto crawling band  $\leq \pm 5\%$
11. Moving band  $\leq \pm 2\%$  (i.e., allows for both appreciation and depreciation over time)
12. De facto moving band  $\pm 5\%$ / Managed floating
13. Freely floating
14. Freely falling
15. Dual market in which parallel market data is missing

The second type classification (they call it coarse) is by merging categories in the above "fine" classification into six groups. Ilzetzki et al grouped categories listed from 1-4 in one

group called pegged regime, those from 5-8 into crawling, from 9-12 into managed, category 13 into floating, category 14 into free falling and 15 into a dual market.

However, not all the ERRs were practiced in the study area within the study period. For example, there was no arrangement called 'dual market with missing parallel market data' and 'free floating'.

Our estimation in table 11 shows that using the 'coarse' classification of ERR crawling regimes are negatively related to inflation compared to having pegged regimes. However, this impact is significant only when IQ is controlled. The result implies that the impact of ERRs on inflation depends on the IQ.

As mentioned before the study also applied the 'fine' classification by controlling the currency board/pre-announced peg. In these estimations, the study found that de-facto crawling peg and crawling band  $\leq 2$  (i.e. the two regimes available in our observations among those classified as crawling regimes) are negatively related to inflation compared to currency board arrangement (except in the GMM with IQ). Moreover, the coefficients of the regimes are significant at least at 90% confidence interval (after adjusting the standard errors).

The coefficients are stronger in the FE estimation compared to the GMM estimation. According to the result of the FE estimation controlling for IQ has only small impact of reducing the value and significance of coefficients. In our present estimation (column 2 and 3) controlling for IQ show impact in opposite direction (reducing the coefficient and significance, unlike the estimation with coarse data). In addition to the above-mentioned dummies 'crawling band  $\leq 5\%$ ' is also negatively and significantly related to inflation in FE model without controlling for IQ.

In the current estimation, the study included lagged inflation as an explanatory variable. The result shows it significantly and positively affects current inflation.

**Table 11: estimation inflation model with robust FE and system GMM**

|         | FE-fine | FE-fine-IQ | FE-coarse | FE-coarse-IQ | GMM-coarse | GMM-coarse-IQ | GMM-fine | GMM-fine-IQ |
|---------|---------|------------|-----------|--------------|------------|---------------|----------|-------------|
|         | Infl    | Infl       | Infl      | Infl         | Infl       | Infl          | Infl     | Infl        |
| lagInfl | 0.197   | 0.21       | 0.229     | 0.248        | 0.244***   | 0.226*        | 0.203**  | 0.138       |
|         | (1.75)  | (2.27)     | (1.9)     | (2.18)       | (3.98)     | (2.56)        | (3.24)   | (1.54)      |
| Pegged  |         |            | Omitted   | Omitted      | Omitted    | Omitted       |          |             |
| Crawl   |         |            | -5.655    | -9.885       | -3.419     | -8.167*       |          |             |

|             |           |               |            |               |             |               |             |               |
|-------------|-----------|---------------|------------|---------------|-------------|---------------|-------------|---------------|
|             |           |               | (-1.21)    | (-1.93)       | (-1.39)     | (-2.05)       |             |               |
| Managed     |           |               | -1.086     | -4.484        | -0.431      | -4.821        |             |               |
|             |           |               | (-0.44)    | (-1.02)       | (-0.19)     | (-1.27)       |             |               |
| Frefall     |           |               | 1.857      | -1.066        | 3.109       | -3.373        |             |               |
|             |           |               | (0.37)     | (-0.18)       | (0.82)      | (-0.61)       |             |               |
| Prepegg     | Omitted   | Omitted       |            |               |             |               | Omitted     | Omitted       |
| Defpeg      | -5.827    | 0.108         |            |               |             |               | -5.178      | 4.461         |
|             | (-1.35)   | (0.02)        |            |               |             |               | (-1.36)     | (0.84)        |
| defcrawlpeg | -9.01**   | -6.941        |            |               |             |               | -5.622      | 0.0071        |
|             | (-4.76)   | (-2.10)       |            |               |             |               | (-1.55)     | 0             |
| Defcband 2  | -9.73**   | -8.091***     |            |               |             |               | -6.305      | -4.853        |
|             | (-3.57)   | (-5.53)       |            |               |             |               | (-1.89)     | (-1.18)       |
| Defcband 5  | -6.816*   | -4.718        |            |               |             |               | -5.487      | -1.964        |
|             | (-2.62)   | (-1.26)       |            |               |             |               | (-1.70)     | (-0.45)       |
| Mfloating   | 0         | 2.225         |            |               |             |               | 2.117       | 7.201         |
|             | (.)       | (0.63)        |            |               |             |               | (0.56)      | (1.43)        |
| Frefalling  | -2.644    | 0             |            |               |             |               | Omitted     | Omitted       |
|             | (-0.96)   | (.)           |            |               |             |               |             |               |
| BMgrowth    | 0.00003   | -0.0525*      | 0.0000441  | -0.0515*      | 0.0000393   | -0.0486       | 0.000023    | -0.0527       |
|             | (0.89)    | (-2.78)       | (1.12)     | (-2.98)       | (0.74)      | (-1.42)       | (0.43)      | (-1.62)       |
| RGDPperC    | -0.365*   | -0.554**      | -0.365*    | -0.585**      | -0.285      | -0.466*       | -0.28       | -0.408*       |
|             | (-2.54)   | (-3.52)       | (-2.46)    | (-4.05)       | (-1.76)     | (-2.50)       | (-1.75)     | (-2.28)       |
| Tradegdp    | 0.1       | 0.101         | 0.133      | 0.133*        | 0.0582      | 0.0878        | 0.000085    | 0.0379        |
|             | (1.58)    | (1.57)        | (2.13)     | (2.4)         | (1.56)      | (1.83)        | 0           | (0.73)        |
| CBIgar      | 8.493     | 12.76         | 5.266      | 5.239         | 12          | 8.937         | 7.048       | 0.0244        |
|             | (0.9)     | (0.73)        | (0.69)     | (0.35)        | (1.7)       | (1.14)        | (0.98)      | 0             |
| FB          | -0.0189   | 0.0383        | 0.0245     | 0.0674        | -0.0352     | 0.0304        | -0.097      | -0.0413       |
|             | (-0.10)   | (0.23)        | (0.13)     | (0.46)        | (-0.24)     | (0.18)        | (-0.64)     | (-0.25)       |
| TOTchang    | -0.0103   | -0.0171       | -0.0171    | -0.0249       | -0.0348     | -0.0311       | -0.0235     | -0.0178       |
|             | (-0.28)   | (-0.86)       | (-0.48)    | (-1.31)       | (-1.44)     | (-1.09)       | (-0.97)     | (-0.64)       |
| corrE       |           | -3.665(-1.34) |            | -5.092(-1.74) |             | -5.884(-1.86) |             | -6.15*(-2.04) |
| effecE      |           | -4.994(-1.55) |            | -3.555(-1.26) |             | 2.586(0.74)   |             | 0.799(0.24)   |
| stabilityE  |           | -1.748(-0.87) |            | -1.114(-0.60) |             | -0.788(-0.47) |             | -2.31(-1.37)  |
| RegQE       |           | -1.133(-0.38) |            | -0.212(-0.09) |             | -5.091(-1.58) |             | -1.58(-0.48)  |
| ROLE        |           | 9.182(1.72)   |            | 7.086(1.28)   |             | 4.163(1.04)   |             | 2.53(0.64)    |
| accounE     |           | 4.864(1.45)   |            | 5.857(1.75)   |             | 3.428(1.06)   |             | 6.4(1.93)     |
| _cons       | 9.93(1.5) | 4.151(0.38)   | 5.59(0.95) | 8.88(0.91)    | 6.465(1.09) | 5.218(0.68)   | 12.13(1.94) | 9.54(1.22)    |
| N           | 167       | 145           | 167        | 145           | 167         | 145           | 167         | 145           |

**Note: Standard Errors are in parenthesis**

Among the control variables in table 11 economic growth (real GDP/Capita growth) is negatively and significantly related to inflation. This is against the view that "economic growth triggers inflation". The result implies that once other factors including the time effect are controlled economic growth in East Africa is not inflationary. Even though it needs more study, it is possible when growth is of the supply side. In addition to growth control variables like; broad money growth (-), openness (+) and CBI (+) were significant at least in one estimation.

All institutional quality indicators are insignificant in the fixed effect estimations (robust). In the GMM estimation estimate of control of corruption is negatively significant in both coarse and fine data estimations. This implies that controlling corruption contributes to the reduction in inflation.

Last, the year dummies are more significant when IQ is excluded. This implies that the significance of year dummies in estimations without controlling WGI could be partly attributed to IQ. Throughout our estimations, dummies of the year 2014 and 2015 were significantly negative (except the year 2015 in the GMM/coarse/IQ estimation). On the other hand, year 2001 is positive and significant in estimations with IQ, except in FE/coarse.

#### **4.2.2 Econometric Analysis of the Growth Models**

In the preceding section (section 4.2.1), the study analyzed the relationship between the choice of ERR and inflation. The other most important economic performance indicator is economic growth. Therefore, in this part, the study tries to show the relationship between the choice of ERR and economic growth, measured by the real GDP per capita growth data of WB.

This section is presented in two sub-sections. The first section presents regression of panel of economic growth data on three-way ERR data of Ilzetzki et al, de-jure classification and IMF using different prominent estimation techniques. Finally, the second part presents results using the improved data and best estimation technique.

##### **4.2.2.1 Primary Estimation of Growth Models**

Under this subsection, the study presents the primary econometric analysis of the relationship between ERR and growth using different models and estimation techniques.

The sub-section is presented in three parts. First, analysis of the growth model controlling for other growth determinant variables is presented. Second, the model controlling for time fixed effects in addition to economic control variables is analyzed. Finally, the study improves the model to control the effect of institutional quality.

#### 4.2.2.1.1 Estimation of the Growth Model Including Control Variables

Table 12 shows that the three-way classification of ERR using the IMF de-facto classification and De-jure classification is not significantly associated with economic growth in East Africa, regardless of the estimation technique used. However, the arrangement using the Ilzetzki et al data shows having intermediate arrangement is negatively related to growth in all pooled OLS, fixed effect, and random effect estimations. The result implies that having an intermediate regime negatively affect economic growth both overtime within a country and between countries compared to pegged regime (there is no floating regime in Ilzetzki et al three-way classification). Having an intermediate regime results in 4.6-4.7 times lower economic growth compared to having a fixed regime.

Among the control variables log of initial GDP per capita, population growth, Schooling, TOT, investment (GDP %) and inflation were found significant at least in some of the estimation techniques. Log of initial GDP per capita is negatively related to economic growth in pooled and random effect regressions, while omitted in the fixed effect regression because it is constant (time-invariant) overtime. The result implies that relatively poorer countries grow faster than richer countries.

The other control variable population growth is significantly positive in pooled and RE estimations. This obviously supports the pro-natalist view i.e. population growth promotes economic growth. Education (school life expectancy) is also found positive in pooled and RE estimations but only when using the IMF and de-jure ERR classification data's. Real TOT is also found positively significant in the same specifications where schooling found significant. Investment (percentage of GDP) is also positively significant in all non-fixed effect estimations. Therefore, the result implies that population growth; education and investment promote economic growth and partly explain the growth difference between East African countries.

Finally, the other control variable, inflation is found negatively significant in the fixed effects (within estimation) in the IMF and de-jure data of regimes. Moreover, it is found to have a negative impact on all estimation techniques when using the Ilzetki data of regime classification.

The surprising result of our regression on table 12 is that three-way arrangement of the Ilzetki et al de-facto regime classification is auto-correlated with the government fiscal policy variables (i.e. fiscal balance and government expenditure). Therefore, in order to keep our target variable, both fiscal variables are dropped. The study also noticed that the results of pooled regression and random effects regression are identical. In other words, the results of ordinary least square and generalized least square are identical.

**Table 12: Estimation of growth model including control variables**

|              | Pooled  | FE       | RE      | Pooled  | FE       | RE      | Pooled   | FE       | RE       |
|--------------|---------|----------|---------|---------|----------|---------|----------|----------|----------|
|              | RGDP/C  | RGDP/C   | RGDP/C  | RGDP/C  | RGDP/C   | RGDP/C  | RGDP/C   | RGDP/C   | RGDP/C   |
| imfthree2    | 2.477   | 1.526    | 2.477   |         |          |         |          |          |          |
|              | (1.34)  | (0.89)   | (1.34)  |         |          |         |          |          |          |
| imfthree3    | 2.201   | 1.697    | 2.201   |         |          |         |          |          |          |
|              | (1.17)  | (0.98)   | (1.17)  |         |          |         |          |          |          |
| dejurethree2 |         |          |         | -0.105  | -1.239   | -0.105  |          |          |          |
|              |         |          |         | (-0.12) | (-0.88)  | (-0.12) |          |          |          |
| dejurethree3 |         |          |         | 0       | 0        | 0       |          |          |          |
|              |         |          |         | (.)     | (.)      | (.)     |          |          |          |
| iltthree2    |         |          |         |         |          |         | -4.57*   | -4.714*  | -4.570*  |
|              |         |          |         |         |          |         | (-1.96)  | (-2.17)  | (-1.96)  |
| loginGDPprC  | -1.435* | 0        | -1.435* | -1.620* | 0        | -1.620* | -1.115*  | 0        | -1.115*  |
|              | (-2.39) | (.)      | (-2.39) | (-2.20) | (.)      | (-2.20) | (-2.15)  | (.)      | (-2.15)  |
| Popgrowth    | 0.760*  | 0.246    | 0.760*  | 0.739*  | 0.264    | 0.739*  | 0.751*   | 0.412    | 0.751*   |
|              | (2.24)  | (0.69)   | (2.24)  | (2.25)  | (0.78)   | (2.25)  | 2.28     | 1.23     | 2.28     |
| School       | 0.315*  | 0.0722   | 0.315*  | 0.325*  | 0.11     | 0.325*  | 0.219    | 0.189    | 0.219    |
|              | (2.14)  | (0.4)    | (2.14)  | (2.29)  | (0.66)   | (2.29)  | 1.64     | 1.19     | 1.64     |
| TOT2000      | 0.0182* | -0.00058 | 0.0182* | 0.0195* | 0.00182  | 0.0195* | 0.0164   | 0.00546  | 0.0164   |
|              | (1.99)  | (-0.04)  | (1.99)  | (2.09)  | (0.13)   | (2.09)  | 1.93     | 0.44     | 1.93     |
| RER          | -0.268  | -0.182   | -0.268  | -0.218  | -0.125   | -0.218  | -0.26    | 0.148    | -0.26    |
|              | (-0.70) | (-0.37)  | (-0.70) | (-0.57) | (-0.27)  | (-0.57) | (-0.72)  | 0.33     | (-0.72)  |
| Invofgdp     | 0.0798* | -0.0339  | 0.0798* | 0.0794* | -0.0326  | 0.0794* | 0.104*** | 0.000416 | 0.104*** |
|              | (2.4)   | (-0.82)  | (2.4)   | (2.46)  | (-0.85)  | (2.46)  | 3.58     | 0.01     | 3.58     |
| Infl         | -0.0597 | -0.0818* | -0.0597 | -0.0549 | -0.0845* | -0.0549 | -0.0645* | -0.0819* | -0.0645* |
|              | (-1.49) | (-2.04)  | (-1.49) | (-1.42) | (-2.15)  | (-1.42) | (-2.08)  | (-2.50)  | (-2.08)  |

|             |          |         |          |          |         |          |         |         |         |
|-------------|----------|---------|----------|----------|---------|----------|---------|---------|---------|
| FBgdpPerc   | -0.0543  | 0.022   | -0.0543  | -0.0568  | 0.0195  | -0.0568  |         |         |         |
|             | (-1.08)  | (0.44)  | (-1.08)  | (-1.17)  | (0.41)  | (-1.17)  |         |         |         |
| GExpPercGDP | -0.0623  | 0.114   | -0.0623  | -0.0764  | 0.103   | -0.0764  |         |         |         |
|             | (-1.40)  | (1.59)  | (-1.40)  | (-1.57)  | (1.5)   | (-1.57)  |         |         |         |
| Tradegdp    | -0.00628 | 0.00325 | -0.00628 | -0.00299 | 0.00667 | -0.00299 | -0.0133 | 0.00866 | -0.0133 |
|             | (-0.35)  | (0.12)  | (-0.35)  | (-0.18)  | (0.24)  | (-0.18)  | (-0.81) | 0.35    | (-0.81) |
| _cons       | 7.285    | 2.171   | 7.285    | 10.78*   | 3.668   | 10.78*   | 11.50** | 6.816   | 11.50** |
|             | (1.51)   | (0.57)  | (1.51)   | (2)      | (1.13)  | (2)      | 2.7     | 1.9     | 2.7     |
| N           | 162      | 162     | 162      | 174      | 174     | 174      | 174     | 174     | 174     |

#### 4.2.2.1.2 Estimation of the Growth Model Controlling the Time Effect

The regression in table 13, in which time effects are controlled in addition to other control variables, shows that using the three-way arrangement of ERR based on IMF or de-jure classifications regimes does not matter for economic growth. However, using the Ilzetzi et al classification having an intermediate regime is significantly related to 5 to 7 time's lower growth compared to having a fixed regime in all estimation techniques. The result is in line with estimation under table-12 without controlling the time effect.

Similar to our table-12 estimation log initial GDP/capita has a negative relationship with growth in non-fixed effect estimations. Moreover, inflation has a negative relationship with growth in the fixed effect estimation regardless of the regime data used.

Again similar to the earlier estimation population growth, real TOT (TOT at the year 2000 constant price) and investment (GDP%) are found positive and significantly related to the economic growth of East African countries in the pooled and random effect regressions. The result implies the variables explain the overall and between countries difference of growth but not the within country (observation) difference overtime.

Unlike, in the case of inflation, most of the year dummies (12 out of 20) are found to be positively correlated with growth at least at 10% degree of freedom in most of the specification except, in estimations with Ilzetzi regime data. Moreover, the result also shows that the significance of the time effect is less important in growth regression compared to inflation modeling.

**Table 13: Estimation of growth model controlling time fixed effect**

|              | Pooled/RE <sup>14</sup> | FE       | Pooled/RE | FE       | Pooled/RE | FE       |
|--------------|-------------------------|----------|-----------|----------|-----------|----------|
|              | RGDPperC                | RGDPperC | RGDPperC  | RGDPperC | RGDPperC  | RGDPperC |
| imfthree2    | 0.95                    | -2.183   |           |          |           |          |
|              | (0.32)                  | (-0.83)  |           |          |           |          |
| imfthree3    | 0.957                   | -1.426   |           |          |           |          |
|              | (0.31)                  | (-0.53)  |           |          |           |          |
| dejurethree2 |                         |          | -0.143    | -1.229   |           |          |
|              |                         |          | (-0.16)   | (-0.88)  |           |          |
| dejurethree3 |                         |          | 0         | 0        |           |          |
|              |                         |          | (.)       | (.)      |           |          |
| iltthree2    |                         |          |           |          | -5.267*   | -6.693** |
|              |                         |          |           |          | (-2.00)   | (-2.72)  |
| loginGDP/C   | -1.498*                 | 0        | -1.617*   | 0        | -1.119*   | 0        |
|              | (-2.43)                 | (.)      | (-2.20)   | (.)      | (-2.14)   | (.)      |
| Popgrowth    | 0.731*                  | 0.0928   | 0.717*    | 0.222    | 0.806*    | 0.533    |
|              | (2.09)                  | (0.25)   | (2.15)    | (0.63)   | (2.37)    | (1.56)   |
| School       | 0.156                   | -0.404   | 0.156     | -0.386   | 0.0312    | -0.293   |
|              | (0.81)                  | (-1.65)  | (0.85)    | (-1.63)  | (0.18)    | (-1.32)  |
| TOT2000      | 0.0234*                 | 0.00982  | 0.0231*   | 0.0151   | 0.0205*   | 0.0167   |
|              | (2.36)                  | (0.66)   | (2.32)    | (1.06)   | (2.25)    | (1.24)   |
| RER          | -0.409                  | -0.117   | -0.407    | -0.0503  | -0.505    | 0.517    |
|              | (-0.99)                 | (-0.18)  | (-0.99)   | (-0.08)  | (-1.32)   | -0.97    |
| Invofgdp     | 0.0804*                 | -0.0581  | 0.0861**  | -0.0329  | 0.105***  | -0.00806 |
|              | (2.33)                  | (-1.40)  | (2.65)    | (-0.86)  | (3.51)    | (-0.22)  |
| Infl         | -0.0456                 | -0.106*  | -0.0482   | -0.113*  | -0.0557   | -0.0866* |
|              | (-0.98)                 | (-2.27)  | (-1.09)   | (-2.47)  | (-1.60)   | (-2.30)  |
| FBgdp%       | -0.0396                 | 0.0215   | -0.0417   | 0.00835  |           |          |
|              | (-0.74)                 | (0.43)   | (-0.81)   | (0.17)   |           |          |
| GExpGDP%     | -0.0624                 | 0.134    | -0.0657   | 0.122    |           |          |
|              | (-1.37)                 | (1.8)    | (-1.32)   | (1.7)    |           |          |
| Tradegdp     | -0.00283                | 0.0371   | -0.00398  | 0.0266   | -0.0136   | 0.00928  |
|              | (-0.15)                 | (1.05)   | (-0.23)   | (0.77)   | (-0.79)   | (0.3)    |
| _cons        | 6.661                   | 3.85     | 8.568     | 1.264    | 12.64**   | 8.427*   |
|              | (1.12)                  | (0.84)   | (1.53)    | (0.34)   | (2.77)    | (2.23)   |
| N            | 162                     | 162      | 174       | 174      | 184       | 184      |

**Note:** Year dummies are removed from the table to make the table more convenient

<sup>14</sup> The random effect and pooled regressions are merged for simplicity because their coefficients and statistics are identical.

#### 4.2.2.1.3 Estimation of the Growth Model controlling Institutional Quality

Table 14 shows a more comprehensive regression considering institutional quality (measured by WGI). The result shows that considering institution has no significant impact on the relationship between ERRs and economic growth. As in table 12 and 13 ERRs based on the IMF and de-jure classifications are insignificant for growth. Moreover, ERR based on the Ilzetzki et al classification does matter for growth, as having intermediate regimes is related to around 10 times lower growth compared to having pegged regime. The only difference here with the results in table 13 is that the coefficient of *iltthree2*<sup>15</sup> is higher (impact of regime is stronger).

Similarly, among the control variables investment remained weakly positive and significant at least at 10% degree of freedom in the pooled/RE. However, Real TOT is weakened and remained significant only under pooled/RE regression using Ilzetzki et al data.

Unlike, in our earlier estimations, initial GDP and population growth became completely insignificant in the present estimations. The result implies that once IQ is considered, initial GDP and population growth does not matter for economic growth in East Africa. However, inflation became significant in all estimation techniques (in table 13, it was significant only under the FE regressions) and regardless of the regime data type used.

Among the institutional quality indicators government effectiveness is positive and significant in all pooled and RE estimations. The result implies that effective governance is associated with better economic growth. In addition to this, the coefficient of voice and accountability indicator is positive and statistically significant in the fixed effect (within) estimations using the de-jure and Ilzetzki et al regime data. The result could mean countries with more accountable institutions had better growth. Nevertheless, the coefficient of control of corruption is negative in all pooled and RE estimations, which is unexpected. Even though, this could need further research but the study suspects it could be either because of measurement error or most observations of the variable are negative.

Regarding the year dummies, like in the case of inflation dummies of year 1997, 1999 and 2001 (which are years in which observations of WGI are missing) were omitted due to

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<sup>15</sup> Intermediate regime using the Ilzetzki et al three way classification

autocorrelation. Apart from this, more than half of the year dummies are significant and positive, at least at 10% degree of freedom, at least in the pooled and RE estimation with de-jure regime data. Most of the significant year dummies are years from 2003 to 2011.

**Table 14: Estimation of growth model considering institutional quality**

|                          | Pooled/RE      | FE             | Pooled/RE      | FE              | Pooled/RE        | FE                |
|--------------------------|----------------|----------------|----------------|-----------------|------------------|-------------------|
|                          | RGDP/C         | RGDP/C         | RGDP/C         | RGDP/C          | RGDP/C           | RGDP/C            |
| imfthree2                | 0.257 (0.09)   | -2.06 (-0.79)  |                |                 |                  |                   |
| imfthree3                | 0.321 (0.11)   | -1.71 (-0.64)  |                |                 |                  |                   |
| dejurethree2             |                |                | 0.294 (0.24)   | -1.299 (-0.90)  |                  |                   |
| dejurethree3             |                |                | Omitted        | Omitted         |                  |                   |
| iltthree2                |                |                |                |                 | -9.768** (-2.78) | -10.12** (-3.07)  |
| loginGDP/C               | -0.748 (-0.94) | Omitted        | -1.031 (-1.33) | Omitted         | -1.127 (-1.74)   | Omitted           |
| Popgrowth                | 0.24 (0.53)    | -0.156 (-0.31) | 0.292 (0.67)   | -0.133 (-0.28)  | 0.406 (0.95)     | -0.0373 (-0.08)   |
| School                   | -0.334 (-1.11) | -0.333 (-1.00) | -0.172 (-0.62) | -0.352 (-1.14)  | -0.238 (-0.99)   | -0.362 (-1.28)    |
| TOT2000                  | 0.0124 (0.96)  | -0.006 (-0.27) | 0.016 (1.32)   | -0.0046 (-0.23) | 0.0231* (2.18)   | 0.00461 (0.27)    |
| RER                      | -0.022 (-0.04) | 0.366 (0.46)   | 0.0836 (0.15)  | 0.333 (0.44)    | -0.229 (-0.49)   | 0.458 (0.77)      |
| Invofgdp                 | 0.0665 (1.67)  | -0.018 (-0.33) | 0.081 *(2.16)  | -0.020 (-0.39)  | 0.0676 (1.94)    | -0.0106 (-0.26)   |
| Infl                     | -0.090 (-1.80) | -0.17** (-3.2) | -0.10* (-2.07) | -0.18*** (-3.6) | -0.0837* (-2.00) | -0.181*** (-4.16) |
| FBgdp%                   | -0.013 (-0.21) | 0.0030 (0.05)  | -0.029 (-0.48) | -0.012 (-0.21)  |                  |                   |
| GExp%GDP                 | 0.0201 (0.37)  | 0.0704 (0.77)  | -0.018 (-0.32) | 0.0303 (0.35)   |                  |                   |
| Tradegdp                 | 0.0153 (0.47)  | 0.035 (0.86)   | 0.0042 (0.14)  | 0.0434 (1.07)   | 0.0184 (0.64)    | 0.0371 (1.13)     |
| CorrE <sup>16</sup>      | -3.72** (-2.7) | -2.951 (-1.68) | -2.70* (-2.18) | -2.037 (-1.24)  | -2.650* (-2.35)  | -2.479 (-1.69)    |
| EffecE <sup>17</sup>     | 5.89** (3.34)  | -1.238 (-0.55) | 5.12** (3.27)  | -0.382 (-0.18)  | 4.586** (3.05)   | -0.878 (-0.45)    |
| StabilityE <sup>18</sup> | 1.12 (1.06)    | 1.115 (0.93)   | 0.635 (0.66)   | 0.651 (0.6)     | 0.175 (0.21)     | 0.134 (0.13)      |
| RegQE <sup>19</sup>      | -2.288 (-1.66) | 0.573 (0.27)   | -2.374 (-1.65) | 1.28 (0.66)     | -1.866 (-1.57)   | 1.318 (0.76)      |
| ROLE <sup>20</sup>       | 1.85 (1.03)    | 0.962 (0.38)   | 1.377 (0.83)   | -0.741 (-0.31)  | 2.057 (1.29)     | 0.0148 (0.01)     |
| AccounE <sup>21</sup>    | -2.567 (-1.62) | 2.556 (1.27)   | -1.109 (-0.81) | 3.949* (2.31)   | -1.214 (-1.03)   | 4.309** (2.88)    |
| _cons                    | 4.807 (0.7)    | 6.973 (1.17)   | 6.668 (1.14)   | 7.944 (1.43)    | 19.23** (3.31)   | 17.72*** (3.58)   |
| N                        | 142            | 142            | 154            | 154             | 160              | 160               |

**Note : standard Errors are in parenthesis**

**Year dummies are controlled but removed from the table for table convenience**

<sup>16</sup> Control of corruption estimate

<sup>17</sup> Government effectiveness estimate

<sup>18</sup> Political stability and absence of violence estimate

<sup>19</sup> Regulatory quality estimate

<sup>20</sup> Rule of law estimate

<sup>21</sup> Voice and Accountability estimate

#### ***4.2.2.2 Final Estimation of the Growth Model***

Following our tests on the inflation model and some additional tests (not reported) made with the growth model the study used the following estimations as a final estimation on the growth model. First, the study used the Ilzetzi et al ERR dataset as it is more diversified and more real de-facto classification. Second, the study applied the FE estimation with robust standard errors (standard errors adjusted for clusters). Third, it used the system GMM model, which generates its own instruments, to control for unobserved heterogeneity. Finally IQ is controlled using the WGI dataset.

The result in table 15 is more or less in line with our findings with the three way classifications. When the 'coarse' classification of regimes is applied the coefficients of all intermediate regimes (i.e. crawling, managed floating and free falling regimes) are negative. Moreover, the coefficient of crawling regime is significant in all estimations; while that of managed floating is significant in most of them (except in FE controlling IQ). In addition to this, the free falling regime is also significant in the FE estimation.

The estimation ranks crawling, managed floating and free falling respectively from bad to worst in the GMM estimation while the inverse is true in the fixed effect estimation. The result implies that having these regimes is negatively associated with 2-6 times lower growth compared to having pegged regime (i.e. having the regimes is associated with 2-6% lower growth than having pegged regime).

In table 15 column 2, 3, 6 and 7 show estimation with more diversified fine classification of ERRs. The results here more or less support our conclusion that running intermediate regimes is growth restricting. Coefficients of de-facto crawling peg, de-facto crawling band  $\leq 2$ , de-facto crawl band  $\leq 5$ , managed floating and free falling are negative in all estimations and statistically significant in the robust FE estimation excluding WGI. Moreover, most of them (except, de-facto crawling band  $\leq 2$  and free falling) are significant in the GMM estimation too.

However, when IQ is controlled almost all the regime dummies of the fine classification became insignificant (except 'free falling regime in FE). These implies that once IQ is controlled the impact of ERRs classified in fine terms do not have much impact on growth. Nevertheless, this doesn't mean ERRs are not important for growth when IQ is controlled

because in the coarse classification regimes become more significant by controlling it. Rather the result could mean that detailed classification of ERRs in 'fine' terms is not important (i.e. the difference between regimes within the crawling range is not important for growth) once IQ is controlled.

Among the control variables in our growth model in table-15 the study dropped fiscal balance and government expenditure due to correlation with the regime dummies. The table shows that inflation is negative and significant for growth in all estimations except, it is insignificant in the FE estimation without controlling IQ. In addition to this initial GDP per capita, population growth and RER are statistically significant in some of our estimations.

Table 15 shows as in table 14, estimate of control of corruption is found significantly and negatively related to economic growth. On the other hand, the estimate of voice and accountability is positive and significant as expected. In addition to these, the estimate of regulatory quality is positive and significant in the fixed effects estimation. The result is in-line with our previous results (table 14). The result implies that better voice and accountability and higher regulatory quality is related to better level of economic growth. However, as explained before (in section 4.2.2.1.3) the sign of coefficient of control of corruption is unexpected.

Estimate of the year dummies shows that, years from 2005 to 2011 positively affected growth compared to year 1996<sup>22</sup>. The year dummies mentioned are statistically significant in all estimations except in estimation applying GMM on the fine classification of ERRs. Additionally years 1997, 2001, 2003 and 2004 are positive and significant in GMM estimation with coarse classification of regimes data. The result implies that unobserved factors in the period between 2005 and 2011 resulted in higher growth in those years relative to year 1996.

**Table 15: Final estimations of the growth model**

|          | FE-Fine | FE-Fine-IQ  | FE-Coarse | FE-Coarse-IQ | GMM-Fine        | GMM-Fine-IQ   | GMM-Coarse   | GMM-Coarse-IQ |
|----------|---------|-------------|-----------|--------------|-----------------|---------------|--------------|---------------|
|          | RGDP/C  | RGDP/C      | RGDP/C    | RGDP/C       | RGDP/C          | RGDP/C        | RGDP/C       | RGDP/C        |
| L.RGDP/C |         |             |           |              | 0.005<br>(0.07) | -0.15 (-1.93) | 0.022 (0.32) | -0.10 (-1.44) |
| Prepegg  | Omitted | 4.59 (1.19) |           |              | Omitted         | Omitted       |              |               |

<sup>22</sup> Results are not reported on the table for convenience (i.e. decrease bulkiness)

|             |                |                |                |               |                |                 |                |                 |
|-------------|----------------|----------------|----------------|---------------|----------------|-----------------|----------------|-----------------|
| Defpeg      | -1.66 (-0.61)  | Omitted        |                |               | -4.14 (-0.93)  | 3.939 (1.42)    |                |                 |
| Defcrawlpeg | -5.0** (-4.8)  | -4.46 (-1.33)  |                |               | -7.69 (-1.77)  | -2.19 (-0.82)   |                |                 |
| Defcrband<2 | -4.52* (-3.0)  | -3.67 (-1.22)  |                |               | -6.67 (-1.57)  | -0.27 (-0.12)   |                |                 |
| Defcrband<5 | -5.1** (-3.8)  | -2.31 (-0.96)  |                |               | -7.04 (-1.67)  | -0.04 (-0.02)   |                |                 |
| Mfloating   | -7.4*** (-5.4) | -4.11 (-1.49)  |                |               | -9.33* (-2.10) | -2.34 (-0.87)   |                |                 |
| Frefalling  | -6.81* (-3.10) | -5.26* (-2.6)  |                |               | -6.08 (-1.43)  | Omitted         |                |                 |
| Crawl       |                |                | -3.47* (-2.7)  | -4.61 (-1.92) |                |                 | -2.84* (-2.0)  | -4.83* (-2.49)  |
| Managed     |                |                | -4.4** (-3.4)  | -3.48 (-1.7)  |                |                 | -2.64 (-1.9)   | -4.13* (-2.05)  |
| Frefall     |                |                | -5.6*** (-4.9) | -6.4** (-3.9) |                |                 | -2.58 (-1.27)  | -4.07 (-1.50)   |
| loginGDP/C  | Omitted        | Omitted        | Omitted        | Omitted       | -1.13 (-0.75)  | -7.0*** (-3.7)  | -1.17 (-0.83)  | -6.3*** (-3.34) |
| Popgrowth   | 0.37* (2.72)   | -0.12 (-0.17)  | 0.29 (1.85)    | -0.22 (-0.33) | 0.23 (0.59)    | -2.76* (-2.10)  | 0.07 (0.19)    | -3.31* (-2.38)  |
| School      | -0.26 (-1.97)  | -0.25 (-1.73)  | -0.27 (-1.77)  | -0.21 (-1.44) | -0.28 (-1.15)  | 0.00052 (0)     | -0.34 (-1.38)  | -0.13 (-0.46)   |
| TOT2000     | 0.012 (0.85)   | -0.001 (-0.04) | 0.006 (0.45)   | -0.01 (-0.40) | 0.019 (1.23)   | 0.017 (1.01)    | 0.007 (0.53)   | 0.023 (1.28)    |
| RER         | 0.659 (1.17)   | 0.458 (0.74)   | 0.38 (0.74)    | 0.11 (0.21)   | 0.35 (0.59)    | 1.44 (1.86)     | -0.13 (-0.20)  | 1.44 (1.67)     |
| Invofgdp    | -0.05 (-1.30)  | -0.002 (-0.03) | -0.05 (-1.67)  | -0.02 (-0.39) | -0.02 (-0.56)  | 0.032 (0.69)    | -0.01 (-0.34)  | 0.04 (0.83)     |
| Infl        | -0.07 (-0.92)  | -0.17 (-2.07)  | -0.08 (-1.23)  | -0.17 (-2.04) | -0.10* (-2.17) | -0.20*** (-3.5) | -0.11* (-2.31) | -0.21*** (-4.2) |
| Tradegdp    | 0.042 (0.65)   | 0.06 (0.97)    | 0.051 (0.95)   | 0.08 (1.24)   | 0.04 (1.46)    | 0.031 (0.88)    | 0.034 (1.2)    | 0.014 (0.4)     |
| corrE       |                | -3.96 (-1.91)  |                | -3.21 (-2.06) |                | -3.79* (-2.56)  |                | -4.20** (-2.78) |
| effecE      |                | -1.09 (-0.55)  |                | -1.49 (-0.73) |                | 0.41 (0.22)     |                | -0.05 (-0.03)   |
| stabilityE  |                | 0.347 (0.21)   |                | 0.13 (0.08)   |                | 1.283 (1.17)    |                | 0.701 (0.68)    |
| RegQE       |                | 2.08 (1.81)    |                | 2.03 (1.88)   |                | 0.637 (0.32)    |                | 1.566 (0.81)    |
| ROLE        |                | 0.77 (0.36)    |                | 0.52 (0.25)   |                | 2.951 (1.38)    |                | 2.872 (1.35)    |
| accounE     |                | 4.31** (3.45)  |                | 4.81** (3.8)  |                | 2.65 (1.54)     |                | 3.18 (1.87)     |
| _cons       | 6.58 (1.55)    | 10.87 (1.13)   | 7.413 (1.68)   | 14.44 (1.79)  | 17.18 (1.56)   | 55.1*** (3.6)   | 12.16 (1.25)   | 55.4*** (3.8)   |
| N           | 184            | 160            | 184            | 160           | 178            | 154             | 171            | 151             |

**Note: Standard Errors are in parenthesis**

**Time effects are controlled but dummies are removed from the table for convenience**

## **CHAPTER 5: CONCLUSION AND POLICY IMPLICATIONS**

### **5.1 Conclusion**

The main objective of the study was to examine the relationship between ERRs and economic performance of East African countries. The study used inflation and economic growth as major economic performance indicators. The study specifically focused on performance of 10 East African countries; namely, Burundi, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, Tanzania, Uganda and Zambia for the period from 1996-2016.

The descriptive analysis shows that fear of floating. The ERR classifications show that the ERRs of East African countries were concentrated in the intermediate category. However, the statistics shows the frequency of claim of intermediate regime is much lower than the practice, which means many countries claim the floating regime but actually run an intermediate regime. Among the three way classifications the IMF classification is the one with the most diversified observations. East African countries according to the other classifications did not significantly change their ERR over the period of study.

Relatively the highest levels of inflation are recorded in Malawi and Zambia while, Uganda had the lowest inflation. Inflation is weakly but negatively correlated with ERR in East Africa. The highest average growth level was that of Mozambique followed by Ethiopia. The lowest average economic growth rate was that of Burundi, followed by Madagascar.

The analysis shows that intermediate regimes are related to lower inflation compared to pegged regimes. Even though, the study used different models and estimation techniques the results are more or less consistent. The analysis also shows that claim of floating regimes are associated with higher inflation. The result of the inflation model after making necessary adjustments and using more segregated regime classifications supports our finding with the three way classification. The result of the 'coarse' classification data shows crawling regimes are negatively related to inflation compared to having pegged regimes. Moreover, estimation of the 'fine' classification shows de-facto crawling peg and crawling band  $\leq 2$  are negatively related to inflation compared to currency board arrangement.

Analysis of the growth model shows that choice of intermediate regime is negatively related to economic growth. Applying the de-jure three way classification data there is no evidence that claim of regimes matter for growth. With the exception of difference in magnitude the choice of estimation techniques (pooled OLS, RE and FE) nor the inclusion of time effect or WGI brought big change on the significance and sign of the coefficient of intermediate regime.

The result of the growth model after making the important adjustments is also more or less consistent. Applying the coarse classification of regimes the coefficients of all intermediate regimes (i.e. crawling, managed floating and free falling regimes) are negative. Moreover, when the study apply the 'fine' classification coefficients of de-facto crawling peg, de-facto crawling band  $\leq 2$ , de-facto crawl band  $\leq 5$ , managed floating and free falling are negative. However, when IQ is controlled in growth regression almost all the regime dummies of the fine classification became insignificant. This implies that once IQ is controlled detail segregation of regimes as in the 'fine' classification is not important for growth (i.e. the difference between regimes within the crawling category is null).

## **5.2 Policy Implications**

The findings of the study shows that the choice of ERR should be based on the policy priority of countries. This is because both inflation and growth are negatively related to intermediate regimes. Therefore, countries with high inflation (or inflation targeting countries) had better move to intermediate regimes from pegged regimes. On the other hand, countries with slow growth rate had better move to pegged regimes from intermediate regimes.

The finding also implies that the choice between wider and narrow bands in the crawling regimes does not matter for economic growth once IQ is considered. It also shows that in the fine classification controlling institutional quality reduces the significance of regimes. Therefore, countries should focus on improving their institutional quality specially, granting voice and accountability and improving their regulatory quality.

### **5.3 Directions for Further Study**

Finally the results call for deeper analysis of the topic. Other interested individuals on the topic could focus on analyzing the impact of regimes on other macroeconomic performance indicators like openness, the likelihood of crisis, financial market integration and so on. More importantly, analyzing the topic in the reverse direction is also important (i.e. what determines the choice of ERR for East African countries?).

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## Appendix

**Appendix Table 1: Estimates of Inflation model including extended form of WGI (including Zimbabwe)**

| Reg with year dummies and control variables + institutional Quality Extended (Random Effects regression with year dummies and control Variables + Institutional Quality Extended) |                    |                    |                    | Fixed Effects regression with year dummies and control Variables + Institutional Quality Extended |                     |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------|---------------------------------------------------------------------------------------------------|---------------------|--------------|
| Variable                                                                                                                                                                          | pooledregin~t      | pooledreg1i~t      | pooledreg2i~t      | Feiqext                                                                                           | fe1iqext            | fe2iqext     |
| imfthree2                                                                                                                                                                         | 8.4896101          |                    |                    | 9.377945                                                                                          |                     |              |
| imfthree3                                                                                                                                                                         | 9.6916189          |                    |                    | 9.8290751                                                                                         |                     |              |
| dejurethree2                                                                                                                                                                      |                    | -1.1260734         |                    |                                                                                                   | <b>-9.0890452**</b> |              |
| dejurethree3                                                                                                                                                                      |                    | (omitted)          |                    |                                                                                                   | (omitted)           |              |
| iltthree2                                                                                                                                                                         |                    |                    | (omitted)          |                                                                                                   |                     | (omitted)    |
| BMgrowth                                                                                                                                                                          | -0.04719401        | -0.04608514        | -0.050795          | -0.0634813                                                                                        | -0.05072387         | -0.06588741  |
| RGDPperC                                                                                                                                                                          | 0.1368287          | 0.07707302         | 0.07698024         | 0.11919247                                                                                        | 0.0427262           | 0.04663543   |
| tradegdp                                                                                                                                                                          | -0.00132453        | 0.03376721         | 0.03253574         | -0.00776986                                                                                       | 0.07364197          | 0.03407639   |
| CBIgar                                                                                                                                                                            | -5.4227065         | -5.7465013         | -4.0520218         | 24.652389                                                                                         | 21.004615           | 19.838006    |
| FB                                                                                                                                                                                | 0.15206439         | 0.08562568         | 0.10218576         | 0.13328355                                                                                        | 0.0095735           | 0.07527988   |
| TOTchang                                                                                                                                                                          | -0.0557454         | -0.04283775        | -0.04154771        | -0.05451649                                                                                       | -0.0487844          | -0.03652524  |
| corrE                                                                                                                                                                             | 2.3244715          | 1.1289007          | 0.88049934         | 0.31262589                                                                                        | -0.8753289          | -1.1205753   |
| effecE                                                                                                                                                                            | -2.9365669         | -1.1878546         | -1.7225861         | -1.9809931                                                                                        | 3.7951621           | 0.7999463    |
| stabilityE                                                                                                                                                                        | -1.444748          | -0.70942327        | -1.0413939         | -3.6304203                                                                                        | -1.585511           | -3.3779395   |
| RegQE                                                                                                                                                                             | <b>-6.1282876*</b> | <b>-7.0528187*</b> | <b>-6.1198856*</b> | -1.5437748                                                                                        | -3.0389124          | -1.7643641   |
| ROLE                                                                                                                                                                              | 3.2636106          | 3.8468391          | 4.1604004          | 3.2283224                                                                                         | -0.0334476          | 2.978233     |
| accounE                                                                                                                                                                           | <b>4.9969496*</b>  | 2.4561624          | 3.3217688          | 8.2113639                                                                                         | 4.1319916           | 5.7164838    |
| year2                                                                                                                                                                             | (omitted)          | (omitted)          | (omitted)          | (omitted)                                                                                         | (omitted)           | (omitted)    |
| year3                                                                                                                                                                             | -18.38884***       | -16.16388***       | -16.48969***       | -21.64526***                                                                                      | -17.84870***        | -18.48965*** |
| year4                                                                                                                                                                             | (omitted)          | (omitted)          | (omitted)          | (omitted)                                                                                         | (omitted)           | (omitted)    |
| year5                                                                                                                                                                             | -9.5248712**       | -9.6697465**       | -9.7712876**       | -12.458934**                                                                                      | -14.20584***        | -12.59008**  |
| year6                                                                                                                                                                             | (omitted)          | (omitted)          | (omitted)          | (omitted)                                                                                         | (omitted)           | (omitted)    |
| year7                                                                                                                                                                             | -15.30586***       | -14.60734***       | -14.77317***       | -18.10068***                                                                                      | -19.17771***        | -17.81701*** |
| year8                                                                                                                                                                             | -14.54056***       | -14.48593***       | -14.80772***       | -18.04214***                                                                                      | -19.03588***        | -18.04393*** |
| year9                                                                                                                                                                             | -13.47314***       | -13.00278***       | -13.21212***       | -16.21978***                                                                                      | -17.71184***        | -16.14405*** |
| year10                                                                                                                                                                            | -15.31200***       | -13.19371***       | -13.42151***       | -16.99038***                                                                                      | -17.13645***        | -15.76145*** |
| year11                                                                                                                                                                            | -14.75421***       | -14.34381***       | -14.66133***       | -18.00316***                                                                                      | -18.96650***        | -17.38898*** |
| year12                                                                                                                                                                            | -13.79260**        | -15.13250***       | -15.36159***       | -17.75865***                                                                                      | -20.08481***        | -18.14697*** |
| year13                                                                                                                                                                            | -9.9307731**       | -9.9459102**       | -10.177218**       | -13.09666***                                                                                      | -14.80317***        | -12.88128*** |
| year14                                                                                                                                                                            | -13.81222***       | -13.23351***       | -13.58075***       | -16.61825***                                                                                      | -17.3145***         | -16.42186*** |
| year15                                                                                                                                                                            | -16.16700***       | -15.84196***       | -16.1804***        | -18.98375***                                                                                      | -19.85608***        | -19.00465*** |

|        |              |              |              |              |              |              |
|--------|--------------|--------------|--------------|--------------|--------------|--------------|
| year16 | -15.97691*** | -14.69414*** | -14.9590***  | -18.43119*** | -19.28608*** | -17.63537*** |
| year17 | -12.40577*** | -12.58378*** | -12.93009*** | -15.32341*** | -16.99705*** | -15.75066*** |
| year18 | -15.31375*** | -15.38692*** | -15.77606*** | -18.54653*** | -20.14089*** | -19.02100*** |
| year19 | -16.34854*** | -16.82432*** | -17.31405*** | -20.24103*** | -21.34953*** | -20.70827*** |
| year20 | -15.43808*** | -15.66809*** | -16.14055*** | -19.20821*** | -20.07947*** | -19.63179*** |
| year21 | -6.5125107   | -13.399225** | -13.797788** | -9.6208759   | -18.33320*** | -17.34829*** |
| _cons  | 18.813537*   | 25.732586*** | 25.187072*** | 8.053774     | 19.873442    | 17.536045    |
| N      | 138          | 150          | 150          | 138          | 150          | 150          |

## Appendix: 2: Heteroscedasticity test

### 1. Test with IMF ERR data

```
. xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (9) =      43.38
Prob>chi2 =      0.0000
```

### 2. Test with De-jure Regime Classification Data

```
. xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (9) =      44.58
Prob>chi2 =      0.0000
```

### 3. Test with Ilzetzki et al Regime Classification Data

```
. xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (9) =      43.97
Prob>chi2 =      0.0000
```

### Appendix: 3: Test of the time fixed Effects

| Test with IMF data                                                                                                                                                                                                                                                                                                                                                                                     | Test With De-Jure Regime data                                                                                                                                                                                                                                                                                                                                                                          | Test with Ilzetzki data                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>. testparm i.year</code>                                                                                                                                                                                                                                                                                                                                                                         | <code>. testparm i.year</code>                                                                                                                                                                                                                                                                                                                                                                         | <code>testparm i.year</code>                                                                                                                                                                                                                                                                                                                                                                           |
| <pre>( 1) 1997.year = 0 ( 2) 1998.year = 0 ( 3) 1999.year = 0 ( 4) 2000.year = 0 ( 5) 2001.year = 0 ( 6) 2002.year = 0 ( 7) 2003.year = 0 ( 8) 2004.year = 0 ( 9) 2005.year = 0 (10) 2006.year = 0 (11) 2007.year = 0 (12) 2008.year = 0 (13) 2009.year = 0 (14) 2010.year = 0 (15) 2011.year = 0 (16) 2012.year = 0 (17) 2013.year = 0 (18) 2014.year = 0 (19) 2015.year = 0 (20) 2016.year = 0</pre> | <pre>( 1) 1997.year = 0 ( 2) 1998.year = 0 ( 3) 1999.year = 0 ( 4) 2000.year = 0 ( 5) 2001.year = 0 ( 6) 2002.year = 0 ( 7) 2003.year = 0 ( 8) 2004.year = 0 ( 9) 2005.year = 0 (10) 2006.year = 0 (11) 2007.year = 0 (12) 2008.year = 0 (13) 2009.year = 0 (14) 2010.year = 0 (15) 2011.year = 0 (16) 2012.year = 0 (17) 2013.year = 0 (18) 2014.year = 0 (19) 2015.year = 0 (20) 2016.year = 0</pre> | <pre>( 1) 1997.year = 0 ( 2) 1998.year = 0 ( 3) 1999.year = 0 ( 4) 2000.year = 0 ( 5) 2001.year = 0 ( 6) 2002.year = 0 ( 7) 2003.year = 0 ( 8) 2004.year = 0 ( 9) 2005.year = 0 (10) 2006.year = 0 (11) 2007.year = 0 (12) 2008.year = 0 (13) 2009.year = 0 (14) 2010.year = 0 (15) 2011.year = 0 (16) 2012.year = 0 (17) 2013.year = 0 (18) 2014.year = 0 (19) 2015.year = 0 (20) 2016.year = 0</pre> |
| <pre>F( 20, 123) = 2.74 Prob &gt; F = 0.000</pre>                                                                                                                                                                                                                                                                                                                                                      | <pre>F( 20, 136) = 3.45 Prob &gt; F = 0.00</pre>                                                                                                                                                                                                                                                                                                                                                       | <pre>F( 20, 137) = 2.86 Prob &gt; F = 0.000</pre>                                                                                                                                                                                                                                                                                                                                                      |

### Appendix: 4: Hausman Test

#### 1. Hausman Test with IMF Data

|           | Coefficients |           | (b-B)<br>Difference | sqrt(diag(V_b-V_B))<br>S.E. |
|-----------|--------------|-----------|---------------------|-----------------------------|
|           | (b)<br>fe    | (B)<br>re |                     |                             |
| imfthree2 | 2.985837     | 3.783165  | -.7973278           | .                           |
| imfthree3 | 1.383736     | 2.918281  | -1.534545           | .                           |
| BMgrowth  | .0000958     | .0001077  | -.0000119           | 8.96e-06                    |
| RGDPperC  | .1967558     | -.0436075 | .2403634            | .0825265                    |
| tradeGDP  | .0002525     | .0210987  | -.0208462           | .0325762                    |
| CBIgar    | 11.52511     | -6.465501 | 17.99062            | 18.91361                    |
| FB        | .1352162     | -.0275473 | .1627636            | .0747843                    |
| TOTchang  | -.0632296    | -.0441454 | -.0190841           | .0004064                    |

b = consistent under Ho and Ha; obtained from xtreg

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

Test: Ho: difference in coefficients not systematic

```
chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
        = 15.16
Prob>chi2 = 0.0341
```

## 2. Hausman test With De-Jure Data

|              | Coefficients |            | (b-B)<br>Difference | sqrt(diag(V_b-V_B))<br>S.E. |
|--------------|--------------|------------|---------------------|-----------------------------|
|              | (b)<br>feD   | (B)<br>reD |                     |                             |
| dejurethree2 | -5.508743    | -.6641238  | -4.844619           | 2.216432                    |
| BMgrowth     | .0000571     | .000091    | -.0000339           | 7.63e-06                    |
| RGDPperC     | .1669958     | .0341805   | .1328153            | .0628536                    |
| tradeGDP     | .0070119     | .019353    | -.0123411           | .0278493                    |
| CBIgar       | 3.04066      | -6.31751   | 9.35817             | 16.92889                    |
| FB           | .0868        | .0235224   | .0632776            | .0506691                    |
| TOTchang     | -.0543135    | -.0430936  | -.0112199           | .                           |

b = consistent under Ho and Ha; obtained from xtreg

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

Test: Ho: difference in coefficients not systematic

```
chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
        = 10.91
Prob>chi2 = 0.0913
```

## 3. Hausman Test with Ilzetzki et al Data

|          | Coefficients |            |                     |                                         |
|----------|--------------|------------|---------------------|-----------------------------------------|
|          | (b)<br>feI   | (B)<br>reI | (b-B)<br>Difference | $\sqrt{\text{diag}(V_b - V_B)}$<br>S.E. |
| BMgrowth | .0000818     | .0000953   | -.0000134           | 8.48e-06                                |
| RGDPperC | .1756267     | .0206275   | .1549991            | .0705772                                |
| tradegdp | -.0026156    | .0210947   | -.0237103           | .028836                                 |
| CBIGar   | 3.196141     | -5.659948  | 8.856089            | 17.20169                                |
| FB       | .1217902     | .0345905   | .0871996            | .0646377                                |
| TOTchang | -.0506775    | -.0421408  | -.0085367           | .0014333                                |

b = consistent under  $H_0$  and  $H_a$ ; obtained from xtreg  
B = inconsistent under  $H_a$ , efficient under  $H_0$ ; obtained from xtreg

Test:  $H_0$ : difference in coefficients not systematic

$\chi^2(5) = (b-B)'[(V_b - V_B)^{-1}](b-B)$   
= 7.39  
Prob> $\chi^2$  = 0.1932

#### Appendix: 4 Description and source of variables

| Inflation Model       |                                            | Source                                                        |                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------|--------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ERR                   | IMF de-facto ERR classification            | ✓ AREAER                                                      | ✓ The system classifies exchange rate arrangements primarily on the basis of the degree to which the exchange rate is determined by the market rather than by official action.                                                                                                                                                                                          |
|                       | De-jure ERR classification                 | ✓ AREAER<br>✓ Official website of each country's Central Bank | ✓ It is the officially claimed ERR of countries declared by central bank of each country                                                                                                                                                                                                                                                                                |
|                       | Ilzetzki et al de-facto ERR classification | ✓ Ilzetzki et al (2016, 2017)                                 | ✓ It is prepared mainly based on the movement of the market determined exchange rate which is mainly the parallel market exchange rate in countries with parallel market                                                                                                                                                                                                |
| Growth of Broad Money |                                            | ✓ WDI                                                         | ✓ Broad money is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial paper. The growth is percentage change per year |
| Real GDP growth       |                                            | ✓ WEO                                                         | ✓ It is the annual growth of GDP measured at the year 2010 constant international \$ prices                                                                                                                                                                                                                                                                             |
| Trade openness        |                                            | ✓ WDI                                                         | ✓ It is Trade (export of goods and services plus import of goods and services), percentage of GDP                                                                                                                                                                                                                                                                       |

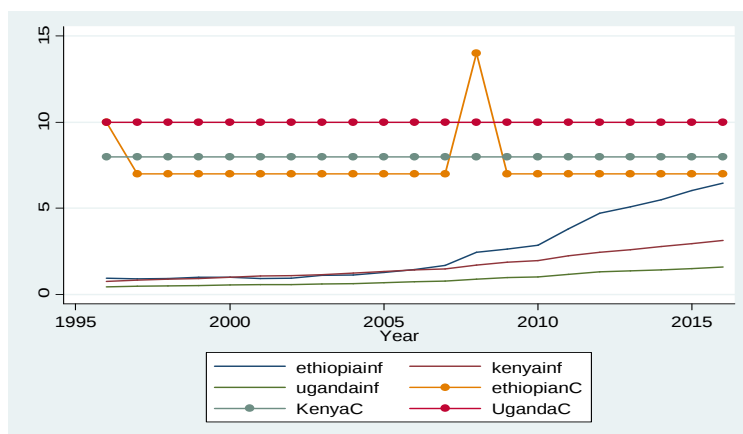
|                                                |                             |                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Central bank independence                      | ✓ CBI dataset Gariga (2016) | ✓ The dataset prepared by Garriga measures CBI using the average and weighted average of central bank CEO turnover rate, CB objectives, policy formulation (reforms) and CB lending. It covers the period from 1970-2012                                                                                               |
| Fiscal balance                                 | ✓ WEO                       | ✓ Government Revenue minus government expenditure of each country                                                                                                                                                                                                                                                      |
| Term of trade (TOT) shocks                     | ✓ AFDB                      | ✓ Change annual change in the terms of trade                                                                                                                                                                                                                                                                           |
| WGI                                            | ✓ WB                        | ✓ WGI is a dataset composing of six measures of good governance which are control of corruption, government effectiveness, political stability and absence of violence, regulatory quality, rule of law, and voice and accountability. The estimate gives marks from +2.5 up to -2.5 from best to worst, respectively. |
| <b>Growth Model</b>                            | <b>Status</b>               |                                                                                                                                                                                                                                                                                                                        |
| ERR                                            | ✓                           | ✓                                                                                                                                                                                                                                                                                                                      |
| Initial per capita income (1996)               | ✓ WDI                       | ✓ GDP per capita of the country at the year 1996 (which is our base year)                                                                                                                                                                                                                                              |
| Population growth (percent per year)           | ✓ WDI                       | ✓ Annual population growth rate for year t is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage.                                                                                                                                                                      |
| School Life Expectancy                         | ✓ ADBG                      | ✓ School life expectancy is defined as the total number of years of schooling which a child of a certain age can expect to receive in the future, assuming that the probability of his or her being enrolled in school at any particular age is equal to the current enrolment ratio for that age.                     |
| Terms-of-trade                                 | ✓ WDI                       | ✓ Net barter terms of trade index is calculated as the percentage ratio of the export unit value indexes to the import unit value indexes, measured relative to the base year 2000.                                                                                                                                    |
| Real exchange rate (Nominal exchange rate/PPP) | ✓ NER (WDI)<br>✓ PPP (WEO)  | ✓ Ratio of nominal exchange rate to purchasing power parity                                                                                                                                                                                                                                                            |
| Investment (percent of GDP)                    | ✓ (WEO)                     | ✓ It is expressed as a ratio of total investment in current local currency and GDP in current local currency.                                                                                                                                                                                                          |
| Inflation (percent per year)                   | ✓ (WDI)                     | ✓ CPI annual percentage                                                                                                                                                                                                                                                                                                |
| Fiscal balance (percent of GDP)                | ✓ (WEO)                     | ✓                                                                                                                                                                                                                                                                                                                      |
| Government spending (percent of GDP)           | ✓ (WEO)                     | ✓ The sum of government expenditure in a fiscal year as a percentage of GDP of the fiscal year                                                                                                                                                                                                                         |
| Trade openness                                 | ✓ WDI                       | ✓                                                                                                                                                                                                                                                                                                                      |

|     |   |   |
|-----|---|---|
| WGI | ✓ | ✓ |
|-----|---|---|

### Appendix 5: summery statistics of sample countries (country 1= Ethiopia country 2= Kenya country 3= Uganda)

| -> country = 1 |     |          |           |        |         |  |
|----------------|-----|----------|-----------|--------|---------|--|
| Variable       | Obs | Mean     | Std. Dev. | Min    | Max     |  |
| gdpconstan-s   | 21  | 8.260333 | 4.814306  | -4.185 | 13.533  |  |
| inflationa-s   | 21  | 251.257  | 193.4151  | 88.835 | 647.214 |  |
| -> country = 2 |     |          |           |        |         |  |
| Variable       | Obs | Mean     | Std. Dev. | Min    | Max     |  |
| gdpconstan-s   | 21  | 4.08519  | 2.332439  | .232   | 8.402   |  |
| inflationa-s   | 21  | 165.9355 | 75.74915  | 74.658 | 313.742 |  |
| -> country = 3 |     |          |           |        |         |  |
| Variable       | Obs | Mean     | Std. Dev. | Min    | Max     |  |
| gdpconstan-s   | 21  | 6.408524 | 2.189576  | 2.24   | 10.428  |  |
| inflationa-s   | 21  | 87.292   | 38.17966  | 44.064 | 158.994 |  |

### Appendix 6: Inflation (Ethiopia, Kenya and Uganda)



**Appendix 7: Economic Growth (Ethiopia, Kenya and Uganda)**

