



LUND UNIVERSITY
School of Economics and Management

**INFLATION TARGETING LITE REGIME IN UGANDA:
HOW EFFECTIVE IS INFLATION TARGETING LITE AS A MONETARY POLICY
FRAMEWORK IN REDUCING INFLATION AND INFLATION VOLATILITY?**

**MASTERS THESIS
(AUGUST 2017)**

Written by

OLIVIA NABBOSA

Supervisor

FREDRIK N G ANDERSSON

Abstract.

This paper analyses the impact of inflation targeting as a monetary policy framework on inflation volatility and inflation rates in Uganda, with a comparison with South Africa and Ghana (full-fledged inflation targeting economies) and Kenya that opted for a forward looking monetary framework. The results show that inflation targeting in Uganda has been efficient in reducing inflation volatility and inflation in Uganda. Empirical findings suggest that persistent supply shocks may hinder the effectiveness of inflation targeting as the case with Ghana. The results also showed that full-fledged inflation targeting economies with less supply shocks have less inflation volatility than economies with transitional regimes as seen from South Africa and Uganda. Secondly empirical findings in this study render a forward-looking monetary policy framework less effective in controlling inflation volatility compared to inflation targeting. Lastly the paper also shows that money growth targeting was inefficient in controlling inflation rates and inflation volatility and hence justifying its abandonment.

Key words

Inflation targeting, inflation targeting lite, inflation and inflation volatility.

TABLE OF CONTENTS.

1. INTRODUCTION.....	4
2. LITERATURE REVIEW.....	7
3. BACKGROUND STUDY.....	11
4. ECONOMETRIC MODEL.....	15
5. EMPIRICAL ANALYSIS.....	18
5.1 DATA DESCRIPTION AND PRELIMINARY TESTS.....	20
5.2 EMPIRICAL MODEL ESTIMATION	24
5.3 DIAGNOSTIC TEST	26
5.4 EMPIRICAL RESULTS.....	27
5.5 INFLATION RATES COMPARISON.....	30
6. LIMITATIONS AND RECOMMENDAIONS.....	32
7. CONCLUSION.....	36
8. REFERENCE.....	37
9. APPENDIX.....	40

SECTION 1

INTRODUCTION.

This paper examines the impact of inflation targeting Lite as a monetary policy regime on Inflation volatility and inflation in Uganda and compares the effectiveness of the policy to other African countries that have adopted full-fledged inflation targeting like South Africa and Ghana and those that have adopted alternative monetary policy framework like Kenya which adopted a forward looking monetary policy. Inflation Targeting (IT) is defined as a monetary policy framework with four key elements namely: (1) price stability being explicitly recognized as the main goal of monetary policy, (2) mechanisms rendering the central bank accountable for attaining its monetary policy goals, (3) the public announcement of targets for inflation and (4) a policy of communicating to the public and the markets the rationale for the decisions taken by the central bank (Mugume, 2011). Carare and Stone,2003 defined Inflation Targeting Lite as a monetary policy regime where countries announce a broad inflation objective but owing to relatively low credibility and unable to maintain inflation as the foremost policy objective. Carare and Stone ,2003 further note that the low credibility in such countries reflects their vulnerability to large economic shocks and financial instability and a weak institutional framework. ITL can be viewed as a transitional regime towards full-fledged inflation targeting (Carare and Stone, 2003). Jahan S,2012 and Masson, P et al,1997 pointed out two main inflation targeting requirements; (1) a central bank able to conduct monetary policy with some degree of independence. (2) the willingness and ability of the monetary authorities not to target other indicators, such as wages, the level of employment, or the exchange rate.

Until the late 1970s most economies deemed monetary policy a less effective strategy to stabilize the economy and control inflation, many economies relied mainly on fiscal policy (Kumo W L, 2015). The fiscal policy approach was based on Keynesian theories. In the early 1970s, the Keynesian theories faced criticism from the Monetarists such as Milton Friedman and Supply-siders who claimed that the ongoing government actions had not helped the economies avoid the endless cycles of below average Gross Domestic Product(GDP) expansion, recessions and volatile interest rates.

According to IMF,2013, beginning in the mid-1970s most economies adopted targets for the growth of monetary aggregates (money stock defined in various

ways). Under this approach Central banks sought to control inflation by aiming for intermediate targets for rates of monetary growth that, for given assumptions about the demand for money, could be expected to deliver the desired rate of inflation. The persistent failures in hitting the monetary targets and persistent instability between the monetary growth and inflation led to the abandonment of monetary targeting in most countries during the 1980s. (IMF 2003 June 1). The shortcomings of monetary growth targeting paved a way for Inflation targeting in the late 1980s, initially industrial and later emerging market economies adopted this monetary policy framework. According to Andersson N G F and Jonung L,2017 the operational goal of inflation targeting is quantified as a single number as the point of target in most cases but due to shocks and uncertainties this goal is unattainable hence inflation targets are set with a band width.

In June 2011 just like other economies, Uganda moved from money growth targeting to inflation targeting that is Inflation Targeting Lite (ITL) as a monetary policy framework. Money growth targeting was abandoned because of various reasons like the rapid growth and diversification of the financial system including innovations in electronic payments, changes in money demand, volatility in the relationship between money and prices, instability and influence of exchange rates made the accurate targeting of money quantity untenable, among others. Inflation targeting lite was adopted as a transitional framework to full-fledged inflation targeting and the primary objective of this policy in Uganda is to hold the annual rate of core inflation to 5% over medium term i.e. 1-2 years and the secondary objective of inflation targeting monetary policy is to align real output as close as possible with the estimated potential output of the economy (Emmanuel T-M,2012).

In the inflation targeting lite regime, an interest rate that is the Central Bank Rate (CBR) became Uganda's monetary policy instrument. The Bank of Uganda sets a monthly Central Bank Rate which it uses to guide the 7-day interbank interest rates. For the last six years, Uganda has executed inflation targeting lite to control inflation and inflation volatility however few scholars have analysed the efficiency of this monetary regime.

For the past two decades, many scholars like Jahan S (2012), Roger S (2010), Bernanke and Mishkin,2015, Carare, Alina and Stone, Mark R (2003) among others have analysed the efficiency of Inflation Targeting as a monetary policy

framework. However most of these studies have mainly focused on the impact of full-fledged Inflation targeting rather than inflation targeting lite regime in a developing country like Uganda.

This paper captures inflation volatility by fitting GARCH- model in monthly Consumer Price Index (CPI) standardized data from March 1992 to March 2017(Data source; Thomson Reuters: -Uganda Bureau). The results of the GARCH model show that Uganda's inflation was very high and volatile before 1992, in the period between 1993 to 2011 the inflation volatility was moderately low and the inflation was moderately high and from 2012 Uganda's inflation volatility reduced to almost a constant rate and the inflation was very low. It should be noted that Inflation targeting Lite was adopted towards the end of 2011 and implemented in early 2012 and this may partly explain the low and stable inflation. The GARCH model results also show that South Africa had the lowest and statistically insignificant inflation volatility amongst the four countries. On the other hand, Kenya has the highest and statistically significant inflation volatility amongst the four countries. The results also showed that Ghana which adopted full-fledge inflation targeting in 2007 has a higher inflation volatility than Uganda which adopted inflation targeting lite in 2011. Lastly it was also noted that between 2013 and 2017, Ghana a full-fledged inflation targeting economy had a high inflation rate and volatility than Kenya that adopted a forward looking monetary policy.

The remaining parts of the paper are organized as follows: Sections 2 discusses the relevant literature about inflation targeting. Section 3 gives a brief background about Uganda's monetary policy and monetary reforms and a brief background about South Africa, Kenya and Ghana's monetary policy. Section 4 gives a description of the Econometric model that is the GARCH model. In section 5 the inflation volatility for Uganda, South Africa, Ghana and Kenya is estimated using the GARCH model, a comparison of the countries' inflation rates is done and empirical findings are also discussed .Section 6 investigates the limitations and recommendations to Uganda. Section 7 concludes the paper.

SECTION 2

LITERATURE REVIEW

It is undisputed that Inflation Targeting, originally a temporary solution to the failed Monetary targeting system has for more than 2 decades continued to gain popularity in both the industrialized and emerging economies as a monetary policy framework (Savastano,1997) and Hammond,2012). Since the early 1990s, inflation targeting has established itself as a monetary policy framework dominating the academic and intellectual debate and exerting a strong influence on central bank practice (Adam M,2014).

Carare A and Mark R.S,2003 classified 46 countries that had adopted inflation targeting into three main regimes based on the clarity and credibility of their commitment to their inflation target and these regimes were full-fledged inflation targeting, eclectic inflation targeting and Inflation Targeting Lite(ITL). In December 1989, New Zealand was the first country to adopt full-fledged inflation targeting. In 2010, 26 countries were using full-fledged inflation targeting as a monetary policy framework that is fixing the Consumer Price Index as their Monetary Policy goal. (Roger S. 2010). In Appendix A, there is a table that shows the 26 countries, the years of adoption, inflation rate at adoption date, the inflation as at 2010 and inflation targets

The emerging economies' adoption to inflation targeting has raised so many questions and speculations which has led to increased research about the subject. Some of the major papers about inflation targeting in emerging economies include Masson P et al, 1997's paper which analyses the prerequisites for inflation targeting in developing countries. Laurens B J, et al, 2015's paper suggests possible solutions to emerging economies that are unable to take on full-fledge inflation immediately. Carare and Stone,2003's paper classifies countries that have adopted inflation targeting into three regimes that is full-fledged, eclectic and Lite inflation targeters. Mishkin,2004 analyses the possibility of inflation targeting being effective in emerging economies and among others. Even though many scholars have shown interest in inflation targeting in the emerging economies, most of these writings are theoretical other than empirical. This paper is an addition to the sparse empirical research on the subject by using Uganda as a case study to analyse the effectiveness of Inflation targeting Lite in a developing country. This section outlines both empirical and theoretical research in this line of study.

In many developing countries, high Inflation rates and volatility or variability have continued to be a threat to economic growth and development. In such economies, full-fledge Inflation targeting would be a feasible solution however the preconditions for the policy such as a high degree of independence of the central bank, willingness not to target any other indicators, well developed financial institutions, high policy credibility and many others (Stone,2003) are far from reality. Laurens B.J, et al,2015 noted that such economies may be unable to adopt a full-fledged inflation targeting immediately but can adopt transitional arrangements. He further states that transitional arrangements enable the Central bank to take advantage of the informational content of monetary aggregates, developing an economic analysis capacity, and concentrating on monetary operations aimed at steering money market interest rates. Inflation targeting lite is a form of transitional arrangement that developing countries can use as a precondition to full-fledged inflation targeting (Stone,2003). Laurens B.J, et al,2015 listed three advantages of transitional arrangements and these are **(1)** *Allows the central bank to buy time, most notably for establishing the technical building blocks for effective monetary policy (including effective liquidity management and economic analysis capacity)* **(2)** *Supports transparency in central bank communication and* **(3)** *Reduces the potential for undesirable outcomes along the road, including the loss of an effective nominal anchor (due to premature switch to IT), or undue delay of monetary policy modernization (due to rigid reliance on monetary targets).* Although Laurens B.J, et al,2015's research is based on theoretical aspects, empirically we have seen an increase in the number of emerging economies that have adopted transitional arrangements like Inflation targeting Lite with a goal to being full-fledge inflation targeters in future such economies include Uganda, Mauritius, Albania, Algeria, Dominican Republic, Jamaica, Guatemala, Croatia, Indonesia among others as identified by Stone,2003.

The main objectives of inflation targeting are to reduce inflation variability or volatility and keep the inflation rate within a given range. The effectiveness of inflation targeting in achieving these primary objectives is open to debate. Lin and Ye,2009 used a variety of propensity score matching methods to show the average treatment effect of inflation targeting on inflation variability is quantitatively large and statistically in thirteen inflation targeting countries. In their study, Lin and Ye,2009 empirical results showed that adoption of inflation targeting led to a fall in the level of inflation by nearly 3 percentage points and significantly lowered inflation variability. Mishkin and Schmidt-Hebbel,2007,

based on empirical evidence from a panel of inflation targeting and a control group of high income non-inflation targeting countries, conclude that inflation targeting helps countries to achieve lower inflation rate and inflation variability compared to non-inflation targeting countries.

Kumo L ,2015 further added to the available literature intended to evaluate the effectiveness of inflation targeting. In this study, emphasis was put on establishing the impact of inflation targeting on inflation volatility and economic growth using South Africa as their case study. In this study, they divided South Africa's monetary policy regimes into two (2) distinct periods that is the pre-inflation targeting regime and the post-inflation targeting regime. The empirical results showed that former regime was characterized by high inflation volatility and rates while the latter was characterized by lower inflation volatility and rates. This meant that inflation targeting had helped to reduce the inflation rates and volatility in South Africa based on the research. In the same research paper, the impact of inflation volatility on economic growth was analysed and the empirical results showed that was a negative relationship between the two variables. This meant that inflation targeting reduces inflation volatility which in turn increases economic growth.

More to the effectiveness of the policy, the IMF's September 2005 *World Economic Outlook* report also noted that adoption of inflation targeting was associated with a 4.8 percentage point reduction in average inflation relative to other monetary policy regimes between 1990 and 2004. Inflation targeting was also associated with a 3.6 percentage point reduction in the variability of inflation relative to other strategies. Although these results may not be directly attributed to the Inflation targeting Lite regime, it is an indication that if emerging economies implement the transitional regime carefully and effectively then they may be able to achieve full-fledge inflation targeting with its optimal benefits like macroeconomic stability (Mishkin,2004).

For the emerging economies that adopted inflation targeting lite like Uganda, the secondary objective of the monetary policy is to align real output as close as possible with the estimated potential output of the economy (Emmanuel T-M,2012). This implies that there is a relationship between inflation and/or inflation volatility and economic growth. The relationship between inflation and economic growth is very ambiguous and is a topic open to debate. Fisher,1993

studies the relationship between inflation and economic growth using several macroeconomic variables and inflation of 93 countries. The empirical findings show a negative relationship between inflation and economic growth. He further argues that inflation distorts price mechanism, which affects the efficiency of resource's allocation and hence influence economic growth negatively. The results from Barro,1997's study did not differ so much from those of Fisher ,1993 as a negative relationship between inflation and economic growth was found. Barro ,1997 analysed the relationship using panel data of 100 countries for a period of 30 years (1960-1990) and a major discovery in his results was that the negative relationship between economic growth and inflation became statistically significant when high inflation was included in the data set. Faraji K and Kenani M,2013 employed a linear regression model to analyse the relationship between inflation and economic growth in Tanzania's CPI data from 1990 to 2011. The empirical results of their study showed a negative relationship between the two variables and concluded that inflation is harmful to economic growth.

Differing from other authors, Mundell,1963, Tobin ,1965, Mallik and Chowdhury ,2001, Ghosh and Phillips,1998 among others found a positive relationship between inflation and Economic growth. Mallik and Chowdhury ,2001 analysed the relationship between inflation and economic growth of four Asian countries that is Bangladesh, India, Pakistan and Sri Lanka. In their study, they used co-integration and error correction model to analyse the data and the empirical findings showed a long run positive relationship between inflation and economic growth. They concluded that moderate inflation is helpful to faster the economic growth.

Other researchers like Rother,2004, Vavra,2014 and Kumo L,2015 directed their research to the impact of inflation second moments to economic growth rather than inflation in absolute terms. These researchers focussed on analysing the relationship between inflation volatility and economic growth. The empirical results from their studies indicated that high inflation volatility had a negative impact on economic growth.

SECTION 3

BACKGROUND STUDY.

Uganda is a small open economy in East Africa which attained its independence from Britain in 1962. Before Independence, Uganda's economy and economic decisions were made by the British government and on October 1962 Uganda was granted its independence. Between 1962 and 1966 the "young" republic of Uganda was incapable of designing and controlling its monetary policy and the power was vested in the East African Currency Bureau which was shared with Kenya and Tanzania. In 1966 under the Bank of Uganda act the Bank of Uganda was formed and empowered with designing Uganda's monetary policy (Musinguzi and Katarikawe, 2000)

Post-Independence Uganda was characterised by political and social struggles that greatly impacted the economic stability of the country (Nyorekwa and Odhiambo, 2014). During this period, monetary frameworks in Uganda were largely geared towards the financing of government activities, the extension of subsidized credit to favoured sectors and an active pursuit of an exchange rate target more often reflecting the interests of powerful urban consumers at the expense of producers, rather than to the control of inflation (Mugume,2011). During this period Uganda experienced increased Fiscal Dominance and Monetary policy conduct was through direct controls on credit and interest rates and the reserve requirements were kept at the same level despite the prevailing circumstances which resulted into inflation rising to double and triple digits leading to real negative interest rate (Nyorekwa and Odhiambo,2014). Adam (2009) defined Fiscal dominance as a situation which the government adopts a fiscal stance that is incompatible with sustaining low inflation without recourse to distortionary fiscal measures (Adam, 2009).

In the late 1980s, Uganda with help from IMF and world bank embarked on achieving macro-economic stability through the Economic Structural Adjustment Program (ESAP) (Mugume,2011). The major focus of the ESAP was to control inflation, increasing competition in the financial sector, price liberalization, deregulation of interest rates, mobilization and allocation of resources, import licensing among other reforms (Nyorekwa and Odhiambo, 2014). Although the structural reforms were proposed and first tried in 1981, macro-economic stability was not attained until the early 1990s (Nyorekwa and Odhiambo,2014). The causes of inflation in Uganda range from political, social, geographical and natural factors such as poor governance, political wars

imported inflation, drought and famine, pests and diseases among others. Following the macro-economic stability that Uganda had attained between 1991 and 1993, money growth targeting was adopted as the formal monetary policy framework to help control inflation.

The adoption of money growth targeting was based on two assumptions and these were; 1) there was a predictable relationship between money and prices (2) that there was a stable and exploitable relationship between the intermediate target, money, and the central bank 's policy instrument (Mugume 2011). However, the rapid growth and diversification of the financial system including innovations in electronic payments, changes in money demand, volatility in the relationship between money and prices, instability and influence of exchange rates made the accurate targeting of money quantity untenable, Monetary targeting was abandoned for Inflation targeting (BOU and Mugume 2011).

In 2011, Uganda announced Inflation targeting Lite as the new monetary policy framework to be pursued by the Central Bank. Uganda's final goal is to adopt full-fledged inflation targeting in the future (Mutebile,2012). Inflation Targeting Lite is carried out in Uganda by BOU influencing the seven-day interbank interest rate also known as the Central Bank Rate (CBR), that is, the rate at which commercial banks grant credit to each other.

In his speech, Emmanuel Tumusiime-Mutebile (Governor Bank of Uganda) at the annual Uganda Bankers' Association dinner (November 2012), noted that the primary objective of the Inflation targeting monetary policy in Uganda is to hold the annual rate of core inflation to 5% over medium term i.e. 1-2 years. In inflation targeting Lite, BOU focuses on core inflation that is a measure of inflation derived from a basket which excludes food crops, fuel, energy and utilities, instead of headline inflation which includes all the items in the consumer basket because it has more control over the core inflation than that headline inflation which originates from the supply side. (Emmanuel T M (2014)). The Governor BOU (2014) further noted that the secondary objective of inflation targeting monetary policy is to align real output as close as possible with the estimated potential output of the economy, although there are practical difficulties with estimating potential output.

Since the adoption of inflation targeting in 2011, Uganda has successfully controlled inflation and maintained it to a single digit figure (currently at 6.8%).

South Africa was the first African country to adopt full-fledged inflation targeting. South Africa first announced its intention to adopt inflation targeting in August 1996 and formally adopted the policy in February 2000, with an objective of maintaining CPI inflation between the target-band of 3 percent to 6 percent by 2002, using discretionary changes in Repurchase (Repo) rate as its main policy instrument. (South Africa Reserve Bank (SARB) et al). SARB further states that before the adoption of inflation targeting framework, the country had pursued many monetary policy frameworks between 1960 and 1998, these included exchange-rate targeting, discretionary monetary policy, monetary-aggregate targeting and an eclectic approach. Prior to 2000, during the mid-to-late 1990s, the SARB took a more eclectic approach to monetary, which essentially involved monitoring a wide range of indicators, such as changes in bank credit extension, overall liquidity in the banking sector, the yield curve, changes in official foreign reserves, changes in the exchange rate of the Rand, and inflation movements and expectations (Uwilingiye, 2010). Uwilingiye, 2010 further notes that this form of informal inflation targeting succeeded in bringing the inflation down to the lower levels in South Africa, but the system of informal inflation targeting at times created uncertainties among the public about the monetary policy stance adopted by SARB thus formal inflation targeting was needed to improve SARB's communication to the public on its monetary policy objectives. Since 2000 when SARB adopted inflation targeting, South Africa has been able to control its inflation with the current rate at 6.0%.

Ghana was the second African country to adopt full-fledged inflation targeting in 2007 after South Africa (seven years). Ghana first announced its intention to adopt this monetary policy framework in 2002 but officially announced adoption of the policy in 2007 with the major objective to keep Ghana's medium-term inflation at $8\% \pm 2$ (Fosu, 2015). Prior to inflation targeting, Ghana conducted monetary policy through monetary aggregates targeting based on the assumption that inflation was a monetary phenomenon and targeting the growth in money supply would help to control it (inflation) (Fosu, 2015). Fosu, 2015 further notes that money supply targeting as a monetary policy in Ghana was faced by several macroeconomic problems like the instability in

prices with inflation going as high as 40.5 percent, the depreciation in the local currency among other. The severe macro-economic problems that Ghana faced justified the adoption of inflation targeting as an alternative monetary policy. Ghana's current inflation rate is 12.8% relatively higher than other inflation targeting countries including Uganda and this is mainly attributed to the high and varying fuel prices in the country.

Differing from Uganda, South Africa and Ghana, Kenya opted for a forward-looking monetary policy to control inflation. Since the late 1990s, Kenya has pursued an inflation objective in the context of a managed float, with reserve money as the operational target, sought to be met through different instruments (Alper, et al 2016). Following frequent misses of monetary targets and the disconnect of these deviations from the actual inflation performance, since 2011 the Central Bank of Kenya (CBK) embarked on modernizing its framework to make monetary policy more forward looking by shifting its operational target away from reserve money. The Central Bank of Kenya (CBK) sets the inflation target at the beginning of every fiscal year and the target is $5\pm 2.5\%$. In the forward-looking monetary framework, the Central Bank of Kenya (CBK) sets Reserve money targets at the beginning of every fiscal year with an intention of correcting the past target misses and using some information about (future) money (Andrle et al 2013). This is like using money targets as forecasts of future money demand, a more sophisticated version of target setting than simple money growth rules (Andrle, et al 2013). CBK using forward-looking monetary policy as a transitional framework to inflation targeting. Kenya has been able to control inflation and the current rate is 9.12% slightly higher than the target. However, inflation volatility is still relatively high compared to inflation targeting countries.

SECTION 4

ECONOMETRIC MODEL.

Inflation is defined as a sustained increase in the general price level of goods and services in an economy over a period. Consumer Price index (CPI) is the best indicator or measure of inflation in an Economy. There are two stylized facts in economic time series data that necessitate the use and analysis of non-stationary (either conditional or unconditional) models. Firstly, some series seem to show no tendency to revert to a long-run mean, and thus can be non-stationary. Secondly, one period of high volatility is often followed by another period of high volatility and vice versa, which is referred to as volatility clustering (Enders, 2010). These two facts are especially true for inflation (CPI) data in sufficiently long horizons and an Autoregressive Conditional Heteroskedastic Model (ARCH) is used to estimate the inflation volatility.

The Autoregressive Conditional Heteroscedasticity(ARCH) model introduced by Engle (1982) was one of the first models that provided a way to model conditional heteroscedasticity in volatility. The model was simple and intuitive but required usually many parameters to describe adequately the volatility process. Bollerslev,1986 extended the ARCH model to the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) which had the same key properties as the ARCH but required far less parameters to adequately model the volatility process (Wennström,2014). Although the ARCH and GARCH models can be used to model volatility, they are faced with a problem of assuming that positive and negative shocks have the same impact on financial data. This assumption is erroneous especially when modelling volatility in financial assets like stocks and exchange rates since positive and negative shocks evidently have asymmetric effects (Enders,2010). To solve this problem, the Nelson (1991) extended the ARCH model to Exponential GARCH(EGARCH) which allows for asymmetric effects of positive and negative asset returns and later Glosten, Jagannathan and Runkle ,1993 extended the model to the GJR-GARCH model which is also frequently used (Wennström,2014). Another problem with the GARCH/ARCH model was data with fat tails and excess kurtosis was misrepresented and it is this reason that Ding, Granger and Engle,1993 introduced APARCH (Asymmetric Power ARCH Model).

The ARCH has many model variants like shown above however in this study, we shall focus on the GARCH (1,1) when modelling inflation volatility in Uganda, South Africa, Kenya and Ghana. In this paper, the GARCH (1,1) is preferred to other variants since monthly consumer price index data is used instead of quarterly or yearly data, with monthly CPI data positive and negative shocks may have negligible effect to inflation volatility in a very short period. It is the same reason why inflation is usually adjusted at an annual rate rather than monthly rate hence making GARCH (1,1) model sufficient in this case.

(G)ARCH Model.

The study of Engle (1982) first introduced the ARCH model which allows the one-step forecast of the variance of the stochastic term to be dependent on the variances of previous stochastic terms. Under the ARCH model, the stochastic term is still independently and identically distributed and thus stationary, while its conditional variance is an auto-regressive process which well represents the volatility clustering observed in some real economic data (Dong and Nabbosa,2017). The ARCH model is then generalized to the GARCH (q, p) model by Bollerslev,1986 by allowing the conditional variance to be dependent on its own lags. The GARCH (1,1) model takes the following form:

$$\varepsilon_t = \sqrt{h_t}v_t \dots\dots\dots (1)$$

Where $\varepsilon_t/I_{t-1} \sim(0, h_t)$ and $v_t \sim iid(0,1)$

$$h_t = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \beta_1h_{t-1} \dots\dots\dots (2)$$

Note that, ε_t is the error term, h_t is the conditional variance of the error term, I_{t-1} is the information set at time t-1, α_0 is the constant in the error’s variance equation, α_1 is the size parameter that captures the influence of the previous shock irrespective of the direction of the shock, $\alpha_0 > 0$, $\alpha_1 \geq 0$, $\beta_1 \geq 0$ and $\alpha_1 + \beta_1 < 1$. And setting $\beta_1 = 0$ in (2) gives the ARCH (1) model.

Although the ARCH model is generalized as GARCH (q, p), most scholars prefer to use only one lag and estimate GARCH (1,1) this is done based on two reasons; the first is that the (squared) residuals from the GARCH (1,1) specification are not serially correlated as will be seen in the next part, meaning that the autocorrelation in the variance is well accounted for by including the first-order lags. It is therefore not necessary to include higher-order lags. The second is that usually a GARCH (1,1) model with three parameters in the conditional variance equation is adequate to obtain a good model fit (Zivot, 2009, Dong and Nabbosa,2017).

In the case of the inflation (CPI) data, we will see in the next section that the (G)ARCH model is required since there is significant autocorrelation in the squared error, which is a clear signal of autoregressive conditional heteroskedasticity.

SECTION 5

EMPIRICAL ANALYSIS

In this section, the data used in this study is described and then transformed for further analysis of stationarity and conditional heteroskedasticity. Then a (G)ARCH-type model is fitted into the data and the results are discussed in detail.

In this study, monthly standardized consumer price index data of Uganda, South Africa, Kenya and Ghana extracted from Thomson Reuters data stream is used when modelling inflation volatility for the four countries. Uganda's CPI data is originally computed by the Uganda Bureau of Statistics with the help of Bank of Uganda (Uganda's Central Bank). South Africa's CPI data is computed by the South Africa Reserve Bank (SARB). Kenya's CPI data is computed by Kenya National Bureau of statistics with the help of the Central Bank of Kenya (CBK). Ghana's CPI data is computed by the Central Bureau of statistics (Ghana) – (CBS). However, it should be noted that Ghana's monthly consumer price index data available on the Thomson Reuter's data stream only starts from 1997 (month 9). The consumer price indices extract can be found in appendix c.

When comparing the inflation rates among the four countries, annual percentage inflation data extracted from the world bank's world development indicators data base is used from 1992 to 2016 and it is presented in the table below.

ANNUAL INFLATION (%)

	Uganda	South Africa	Kenya	Ghana
1992	52,44227	13,87470208	27,33236	10,05612
1993	1,163983	9,717446554	45,97888	24,95984
1994	10,03676	8,938547486	28,81439	24,87026
1995	6,55014	8,680425266	1,554328	59,46155
1996	7,191647	7,354125906	8,864087	46,56102
1997	8,169021	8,597770154	11,36185	27,88521
1998	0,068804	6,880552813	6,722437	14,62417
1999	5,777369	5,181490718	5,742001	12,40867
2000	3,392022	5,338953284	9,980025	25,19322
2001	1,865125	5,701900634	5,738598	32,90541
2002	-0,28751	9,164037855	1,961308	14,81624
2003	8,680477	5,858979916	9,815691	26,67495
2004	3,721287	1,385381833	11,62404	12,62457
2005	8,448726	3,399299946	10,31278	15,11819
2006	7,310676	4,641624894	14,45373	10,91517
2007	6,138511	7,098419808	9,75888	10,73273
2008	12,05086	11,53645077	26,23982	16,52214
2009	13,01726	7,13	9,234126	19,25071
2010	3,976553	4,257415985	3,961389	10,70757
2011	18,6929	5,000472634	14,02155	8,726837
2012	14,01606	5,653583003	9,378396	9,160778
2013	5,464402	5,751533742	5,718274	11,60833
2014	4,288209	6,067198453	6,877498	15,49317
2015	5,225427	4,588271042	6,582411	17,14507
2016	..	6,3262638	6,297548	17,47392

Source: World Bank (World Development indicators).

5.1 DATA DESCRIPTION AND PRELIMINARY TEST.

Consumer Price index is defined as a measure used in estimating changes in the *price* level of market basket of *consumer* goods and services purchased by households. Since inflation is the increase in the general prices of goods and services, then consumer price index is considered a good indicator for inflation. In this study, monthly standardized Consumer Price Index data (1992M3-2017M04) for Uganda, South Africa and Kenya and for Ghana (1997M9-2017M4) is used to represent inflation as the difference between the CPI in the current month and CPI from the previous month that is $(cpi_t) - (cpi_{t-1})$.

In the past, Uganda's inflation rate has been very dynamic driven by both internal factors like political turmoil, natural hazards, fiscal dominance among others and external factors like increase in petroleum prices, increased import prices among other. Inflation in Uganda has in the past reached double highs like 52.45% in 1992 and single digit lows like -0.29% in 2002. In 2011, Uganda's inflation rate rose from 3.9% registered by end of 2010 to 18.7% and this was the final blow to money growth targeting as a monetary policy framework and adoption of inflation targeting lite. From 2012 when ITL was adopted Uganda's inflation rate has been maintained at a single digit figure and currently 5.7% as at 2017 July.

5.1.1 Unit root test (Stationarity Test)

When estimating volatility using a GARCH process, it is very important that the data provided is stationary to enable economic analysis and interpretation of results and it's this reason that stationarity in the inflation data is tested. First, logarithms of the CPI data are taken, this is not very important but it makes interpretation of the data easier. The lognormal family of distributions is the most convenient for obtaining straightforward mathematical results as noted by Taylor, 2008.

After taking the logs of the data a unit root test is performed that is an Augmented Dickey-Fuller test on Uganda, South Africa, Kenya and Ghana's inflation data (first difference of the consumer price indices). The Augmented Dickey-Fuller test is carried out in two forms; first considering data with the intercept without a trend and second is considering data with both the intercept and trend. The results of the unit root test are summarized in table 1 below.

Table 1: Augmented Dicky-Fuller Test on Uganda, South Africa, Kenya and Ghana's Inflation data (1992-2017)

Table 1:

Unit root test.

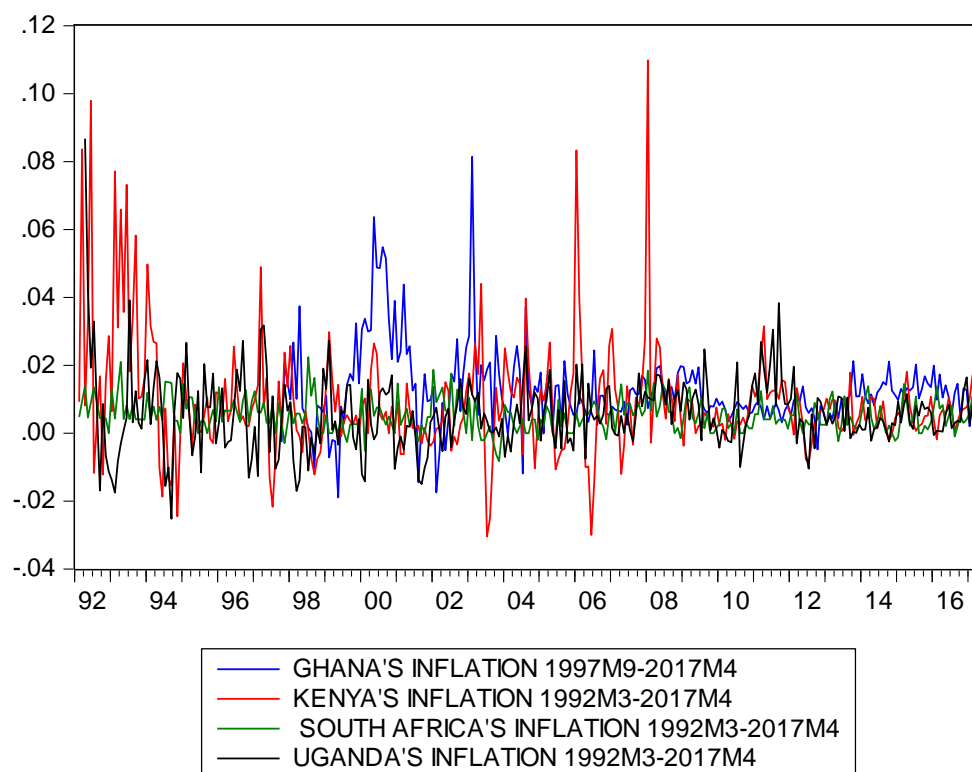
Null hypothesis: $\log(cpi_t) - \log(cpi_{t-1})$ has a unit root

	SOUTH AFRICA	KENYA	GHANA	UGANDA
<i>Intercept + trend</i>				
<i>ADF test</i>	-13.35847*** (0.0000)	-12.38898*** (0.0000)	-6.613143*** (0.0000)	-13.38633*** (0.0000)
1%	-3.988737	-3.988635	-3.999740	-3.989048
5%	-3.424775	-3.424726	-3.430104	-3.424926
10%	-3.135465	-3.135436	-3.138608	-3.135554
<i>Intercept-no trend</i>				
<i>ADF test</i>	-13.13229*** (0.0000)	-12.17833*** (0.0000)	-4.091705*** (0.0012)	-13.38252*** (0.000)
1%	-3.451847	-3.451775	-3.458470	-3.452066
5%	-2.870899	-2.870868	-2.873809	-2.870996
10%	-2.571828	-2.571811	-2.573384	-2.571880

*Notes: 1. t-statistic probability is reported in parentheses. 2 ***, **, * represents statistical significance at 1%,5% or 10% respectively.*

From table 1, ADF t-statistics for South Africa, Kenya, Ghana and Uganda in absolute terms are greater than all the critical values at all the levels of significance (1%, 5% and 10%) for the inflation data at both intercept-no trend and intercept + trend levels. The ADF t-statistic probabilities are also less than 5% and highly significant at 1% level of significance. Based on these observations, the null hypothesis ($\log(cpi_t) - \log(cpi_{t-1})$ has a unit root) can be rejected and the inflation data is stationary.

figure-1: MONTHLY LOGARITHMIC INFLATION FROM 1992M3-2017M4



From figure 1, above it is observed that the monthly logarithmic inflation of Uganda, Kenya, South Africa and Ghana is mean reverting and this is a proof for stationary as shown by the ADF test results.

5.1:2 Heteroskedasticity Test

Before the inflation volatility is estimated, it is necessary to also check if the data is characterized by conditional heteroskedasticity since the ARCH models are used if this condition is satisfied. ARCH-type heteroskedasticity in the data is tested using a Breusch-Godfrey serial correlation LM test and the results are summarized in table 2 below.

Table 2: Heteroskedasticity Test on Uganda’s Inflation 1992-2017**Null-hypothesis: No ARCH-type heteroscedasticity****UGANDA**

F-statistic	65.13682	Prob. F (1,297)	0.0000
Obs*R-squared	53.78052	Prob.Chi-square (1)	0.0000

SOUTHAFRICA

F-statistic	5.893383	Prob. F (6,296)	0.0000
Obs*R-squared	32.33390	Prob.Chi-square (6)	0.0000

KENYA

F-statistic	4.761125	Prob. F (1,297)	0.0029
Obs*R-squared	13.81152	Prob.Chi-square (3)	0.0032

GHANA

F-statistic	21.51076	Prob. F (1,232)	0.0000
Obs*R-squared	19.85524	Prob.Chi-square (1)	0.0000

From table 2, the probabilities of the F-statistic and chi-square for Uganda, South Africa, Kenya and Ghana are less than 5% and the null hypothesis “no ARCH-type heteroscedasticity” is rejected at 1% level. This means that there is conditional heteroskedasticity in the data. However, it should be noted that unlike Uganda and Ghana, heteroscedasticity in South Africa and Kenya’s data is detected when the number of lags is increased to six and three respectively. This implies that the heteroscedasticity is almost negligible for these two countries. In the next subsection, inflation volatility for Uganda, South Africa, Kenya and Ghana is estimated using GARCH (1,1) model and results summarized in table 3.

5.2 EMPIRICAL MODEL ESTIMATION.

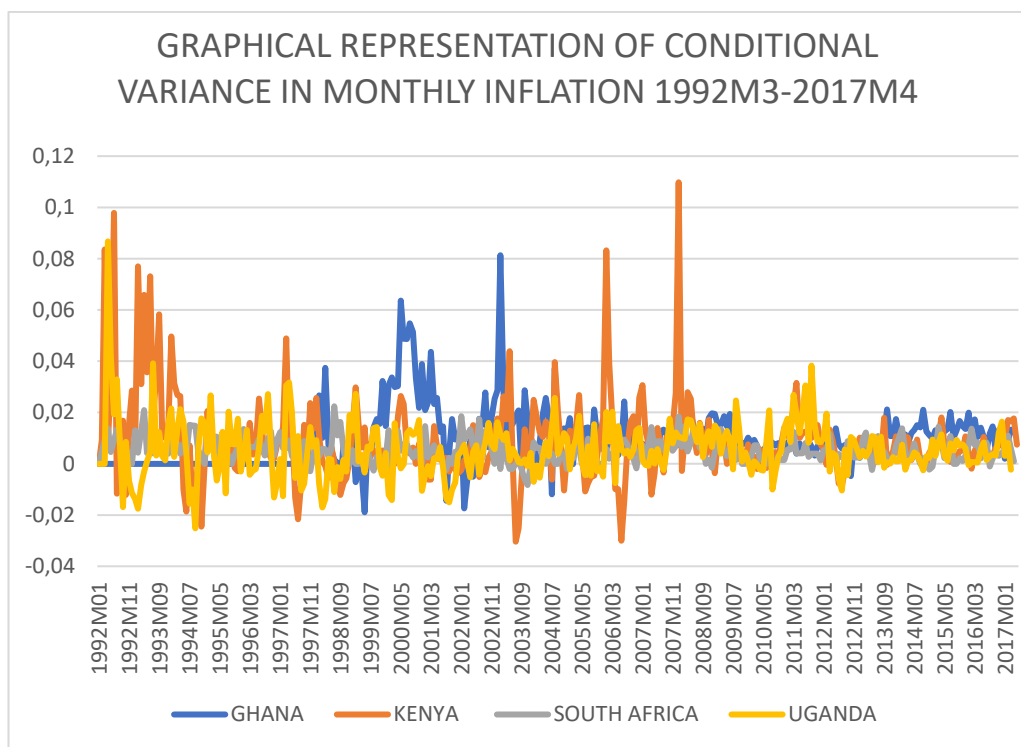
Estimating Volatility inflation volatility for Uganda, South Africa, Kenya and Ghana, GARCH(1,1)Model (March/1992-April/2017).

In this subsection, equations 1 and 2 specified in chapter 4 are estimated in E-views using Maximum Likelihood to measure volatility in Uganda, South Africa and Kenya's inflation from March 1992 to April 2017 and Ghana's inflation from September 1997 to April 2017. The model is estimated under two conditions and these are; (1) the stationarity i.e. $\alpha_1 + \beta_1 < 1$ and (2) nonnegativity i.e. $\alpha_0 > 0$, $\alpha_1 \geq 0$, $\beta_1 \geq 0$. The estimated results are summarized in table 3 and the volatility trend in the inflation of Uganda, South Africa, Kenya and Ghana is presented in figure 2 below.

Table 3: Estimated GARCH models

	1 UGANDA	2 SOUTH AFRICA	3 KENYA	4 GHANA
<i>mean equation</i>				
α_0	0.005116*** (0.000486)	0.005175*** (0.000315)	0.006602*** (0.000704)	0.010534* (0.000447)
<i>Variance equation</i>				
α_0	3.49E-06* (1.92E-06)	1.42E-05* (1.52E-05)	9.15E-07* (8.60E-07)	6.16E-07* (4.34E-07)
α_1	0.177645*** (0.053227)	0.066842* (0.061141)	0.096373*** (0.011841)	0.12546*** (0.036496)
β_1	0.779527*** (0.044619)	0.303943* (0.719422)	0.905610*** (0.007222)	0.871782*** (0.027640)
<i>Goodness fit</i>				
Log likelihood	981.7645	1192.159	877.0631	791.4173
AIC	-6.518430	-7.842632	-5.743836	-6.701424
BIC	-6.469046	-7.793606	-5.694928	-6.642537
Durbin-Watson	1.115393	1.461398	1.291743	0.924749
<i>Notes: 1. standard Deviation is reported in parentheses. 2 ***, **, * represents statistical significance at 1%,5% or 10% respectively.</i>				

Figure 2: CONDITIONAL VARIANCE IN UGANDA, SOUTH AFRICA, KENYA AND GHANA'S MONTHLY INFLATION 1992M3-2017M4



Source: Author's analysis.

Figure 2 above is a graphical representation of the conditional variance of the four countries generated by estimating GARCH (1,1) models of the individual countries. The y-axis of figure 2 represents the GARCH variance series generated in E-views. The empirical findings of this figure are discussed in detail in subsection 5.4.

5.3 The volatility Persistence test in the GARCH (1, 1) model.

Although the error terms in the GARCH process are uncorrelated, the squared errors in a GARCH (1,1) process are correlated and one should be able to show that the degree of autoregressive decay is $\alpha_1 + \beta_1$ (Enders,2010). This is generally referred to as unit root in volatility and the test is commonly carried out using the Wald Test. The null hypothesis of a unit root for volatility models is stated as $\Phi = 1$ where Φ is the persistence parameter that equals $\alpha_1 + \beta_1$ for the GARCH (1, 1) model i.e. $\alpha_1 + \beta_1 = \Phi = 1$. Taylor,2005 further notes that although $\Phi = 1$ represents non-stationary models, $\Phi = 1$ in GARCH models represents strict stationarity. Enders (2010) also notes that large values of both α_1 and β_1 act to increase the conditional volatility but they do so in different ways; the larger α_1 is, the larger the response of h_t to new information and if α_1 is large, a v_t shock has a sizable effect on ε_t^2 and h_{t+1} . The test result for GARCH (1,1) is shown in Table 3 and discussed in detail in subsection 5.4.

Table 3: Wald Test for Volatility Persistence in the GARCH (1,1) model.

Null Hypothesis: C (3) +C (4) = $\Phi = 1$				
	1	2	3	4
	UGANDA	SOUTHAFRICA	KENYA	GHANA
<i>mean equation</i>				
<i>t-statistic</i>	-1.335282* (0.1828)	-0.916824* (0.3600)	0.295352* (0.7679)	-0.221570* (0.8248)
<i>F-statistic</i>	1.782979* (0.1828)	0.840566* (0.3600)	0.087233* (0.7679)	0.049093* (0.8248)
Chi-square	1.782979* (0.1818)	0.840566* (0.3592)	0.087233* (0.7677)	0.049093* (0.8246)
Normalized Restriction (=0)				
- $\Phi + C (3) + C (4)$	-0.042828 //0.032074//	-0.629215 //0.686298//	0.001982 //0.006711//	-0.002756 // 0.012437//

*Notes: 1. Probabilities of the statistics are reported in parentheses. 2 ***, **, * represents statistical significance at 1%,5% or 10% respectively. 3 //...// reports the standard errors*

5.4 EMPIRICAL RESULTS.

In this subsection, results from subsections 5.2 and 5.3 are discussed in detail.

From table 2, we note that Kenya's previous period's conditional variance coefficient ($\beta_1=0.905610$) is higher than that of Uganda, South Africa and Ghana. This implies that Kenya has the highest inflation volatility compared to the other countries considered in this study and it can be concluded that countries that have adopted inflation targeting as a monetary policy framework have lower inflation volatility compared to those that have adopted alternative monetary policy frameworks.

From table 2 it is noted that South Africa has the lowest previous period's conditional variance ($\beta_1 = 0.303943$) however it is statistically insignificant with a t-statistic probability greater than 5%. This can be drawn to the fact that South Africa was the first African country to adopt full-fledged inflation targeting in 2000 and after seventeen years of practising the monetary policy framework, it has been able to make the necessary structural and institutional reforms like building and strengthening the credibility of the SARB, increased degree of independence of the SARB and the ability to target no other economic parameter other than inflation that have enabled it to maximize the benefits of the policy that is reducing the inflation rate and inflation volatility.

An interesting observation to note from table 2 is that Ghana's previous period conditional variance ($\beta_1=0.871782$) is statistically significant and greater than Uganda's ($\beta_1=0.779527$). This empirical observation implies that Ghana is experiencing a higher inflation volatility than Uganda. Ghana adopted full-fledged inflation targeting monetary policy framework in 2007 while Uganda adopted Inflation targeting Lite in 2011 (four years after Ghana). This could also imply that regardless of the inflation targeting regime an economy adopts, the effectiveness of the policy in reducing inflation volatility depends on how it is implemented and the economic conditions prevailing in the given economy. However, it should also be noted that while Ghana uses headline inflation when implementing inflation targeting, Uganda uses core inflation. Core inflation excludes fuel and food prices in the basket of consumer goods while headline inflation includes them which means the former is affected by supply shocks and is prone to higher volatility than the latter and therefore it is hard to compare the performance of Uganda and Ghana, hence this empirical finding is inconclusive.

It is also observed that though both Ghana and South African are both full-fledged inflation targeting economies, Ghana's inflation volatility is so high as compared to South Africa and this is seen from Ghana's previous period conditional variance coefficient $\beta_1=0.871782$ which is higher than South Africa's $\beta_1 = 0.303943$. This empirical finding is attributed to Ghana's persistent supply shocks like the high and fluctuating fuel prices which continuously distorted the economy's stability and which is not the case in South Africa.

From figure 2 and Appendix B, we see that Uganda's inflation was very high and volatile before 1992, in the period between 1993 to 2011 the inflation volatility was moderately low and the inflation was moderately high and from 2012 Uganda's inflation volatility reduced to almost zero and the inflation was very low. It should be noted that Inflation targeting Lite was adopted towards the end of 2011 and implemented in early 2012 and this explains the low and stable inflation. Comparing the conditional variance of the four countries in figure 2, South Africa has the lowest conditional variance which ranges between 0.00 00 and 0.000044 (appendix B) almost equal to zero hence very insignificant. This agrees with the results in table 2 which shows that South Africa's conditional variance in inflation is statistically insignificant.

In figure 2, it is also noted that Uganda and Ghana's conditional variance reduces after the adoption and implementation of inflation targeting that is Uganda's conditional variance reduced to almost zero at the beginning of 2012 while Ghana's reduced at the beginning of 2008 and therefore we can conclude that inflation targeting has a negative impact of inflation volatility.

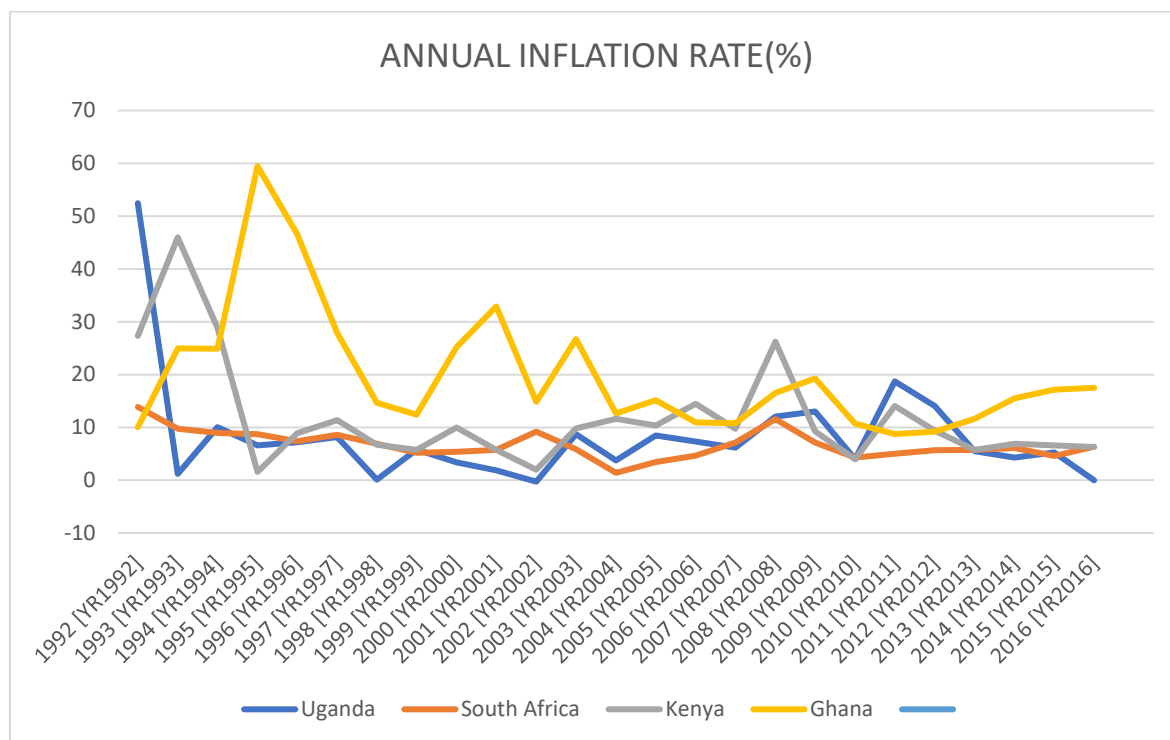
From figure 2 it is observed that between 1992M3 to 2010M7, Kenya's conditional variance in inflation was higher than that of Uganda and South Africa. However, around 2011M3 Kenya's conditional variance reduced and this may be attributed to Kenya's adoption of the forward looking monetary policy in 2011 and abandoning money targeting.

From table 3, the null hypothesis of unit root cannot be rejected at every level of significance i.e. all the p-values of all the test statistics are higher than 5%. This implies that there is high volatility persistence in Uganda, South Africa, Ghana and Kenya's inflation and is likely to have a long-term effect on other economic variables like Economic growth, labour wages, among others. This also implies economies should very vigilant in controlling inflation volatility as it may have more advance effects than the inflation rate.

It should also be noted that among the four countries, Uganda's previous shock has the highest influence on inflation volatility compared to South Africa, Kenya and Ghana. This is seen from the size of the parameter $\alpha_1 = 0.177645$ which is higher than 0.066842, 0.096373 and 0.12546 for South Africa, Kenya and Ghana respectively. This also implies that Uganda's inflation volatility has a higher response to new information than South Africa, Kenya and Ghana and this is based on Enders 2010.

5.5 INFLATION RATES COMPARISON.

Figure 3. Comparison of the inflation Rate between Uganda, South Africa, Kenya and Ghana



Source: Author's analysis

From figure 3, the following empirical observations can be made;

Ghana's inflation rate in the period under consideration is relatively higher than that of Uganda, South Africa and Kenya. This can be attributed to supply shocks especially the fluctuating fuel prices in Ghana that have characterized the economy in the period under study. This empirical finding implies that supply shocks have a huge impact on the effectiveness of any monetary policy framework in controlling inflation.

South Africa's inflation rate is considerably lower than the other countries under study. For the past seventeen years South Africa has practised full-fledged inflation targeting meaning it has had enough time to adjust its economic structure to accommodate and utilise the benefits of the monetary policy.

On the other hand, Ghana's inflation rate is slightly higher than that of Uganda even if it adopted full-fledge inflation targeting ten years ago, four years before Uganda adopted inflation targeting lite. This can be attributed to the fact that Ghana and Uganda differ in how they set their inflation targets; the former focuses on headline inflation while the latter focuses on core inflation. This makes the comparison of the effectiveness of the policy in the two countries inconclusive but we note that the inflation measure plays a big role in the results of the inflation targeting regime whether full-fledged or Lite. From this a conclusion can be made that inflation targeting Lite can equally be efficient as full-fledged inflation targeting in reducing inflation rates and inflation volatility if implemented in "supply shock-free" periods.

Lastly, we also note that from 2013 to 2017, Ghana has the highest inflation rate and inflation volatility; even higher than that of Kenya that has adopted a forward looking monetary policy other than any form of inflation targeting. From this we can conclude that the effectiveness of a monetary policy framework greatly depends on the economic factors in the country and how much control the policy makers have over these variables for instance the high inflation rate and volatility in Ghana between 2013 to 2017 was resulting from supply shocks like the rise of the fuel prices which the central bank has less control over.

From the empirical evidence presented in subsections 5.4 and 5.5, it can be concluded that inflation targeting Lite has been efficient in helping to reduce the inflation rate and volatility in Uganda, however the framework is still faced with some limitations. These limitations may still make it hard for Uganda to achieve full-fledged inflation targeting like South Africa, Ghana and other industrialized countries. In the next chapter, some of these limitations are identified and possible solutions are presented.

CHAPTER 6:

LIMITATIONS TO THE IMPLEMENTATION OF INFLATION TARGETING LITE IN UGANDA AND RECOMMENDED SOLUTIONS.

According to Mutebile, 2012 (Governor Bank of Uganda), Uganda adopted Inflation targeting lite as a precondition monetary policy to full-fledge inflation targeting like the industrialized countries. However, this dream maybe far from reality if the following limitations still exist in the economy;

Independence of the central bank.

For Inflation targeting to be an efficient monetary policy framework, the central bank should have some degree of independence from the government. Mishkin,2004 stated that for inflation targeting to be a success there should be a public and institutional commitment to instrument independence of the central bank. He defines instrument independence as the central bank being prohibited from funding government deficits, must be allowed to set monetary policy instruments without interference from government and the members of the monetary policy board must be insulated from the political process by giving them long-term appointments and protection from arbitrary dismissal. The independence of central bank of Uganda is questionable this is evident from facts like under Uganda's constitution the governor of the central bank is solely appointed by the president of the republic of Uganda which means his actions cannot differ so much from the interests of the government. In 2011 Uganda was hit by hyperinflation reaching figures as high as 30 % by the end of 2011. Daily Monitor a local newspaper in Uganda on 14/10/2011 published an article blaming the hyperinflation in the economy on excessive liquidity caused by hundreds of billions of the previous' year's surplus government budget used to purchase government fighter jets. The leader of opposition Dr Kiiza Besigye also in a public address on 16/01/2012 blamed the hyperinflation on the Central Bank's printing of banknotes amounting to two trillion shillings to fund the presidential campaigns in 2010. The Bank of Uganda on 19/01/2012 made a press release on Uganda Radio Network (URN), denying the allegations and blamed the inflation on supply shocks like drought and high fuel prices. Although this may have been political propaganda but such allegations greatly undermine the credibility of the monetary policy makers. For Uganda to achieve full-fledged

inflation targeting, clear boundaries should be drawn between the government and the Central bank.

Fiscal instability

Mishkin,2004 noted that irresponsible fiscal policy put pressure on the monetary authorities to monetarize the debt which may lead to rapid money growth hence inflation and in the worst-case scenario inflation targeting may be abandoned to focus on the fiscal policy. In Uganda's financial budget 2017/8 presented on 22 May 2017, 12% of the total budget that is 725.6 billion Uganda shillings will be used to pay interest on the external debt. This should be noted that the portion of the financial budget allocated to external debt interest is higher than that allocated to the key sectors of the economy like the Education, Health and agriculture. This is evidence that Uganda's fiscal policy is a threat to the monetary policy and there is a risk of fiscal dominance. The problem of fiscal imbalance may not be solved in a short period of time however, to enable inflation targeting to be effective in reducing inflation rate and volatility, increased central bank independence is recommended. This will enable the central bank to implement the monetary policy without fiscal pressure.

Weak financial institutions

Mutebile,2012 noted when the central bank adopted inflation targeting lite, Central Bank Rate (CBR) also referred to as the inter-bank rate was chosen to be the nominal anchor of inflation in Uganda. In this policy, the central bank controls and influences the seven-day inter-bank (CBR) which in turn enables it to control the entire spectrum of market interest rates. However, the banking sector in Uganda is still underdeveloped and financial services are limited to urban areas. The banking institutions are operating in an Oligopoly market where their main drive is maximising profits and not service delivery which makes it so hard for the central bank to regulate them. The banks in Uganda charge very high tariffs to their customers coupled with very high lending rates for example a current bank account in Uganda on average charges between 10,000 and 25,000 shillings per month. This has discouraged many Ugandans especially those operating in the informal sector from using banks and have resorted to using mobile money services provided by the telecommunication networks with lower tariffs and easy accessibility. This complicates the

implementation on inflation targeting as a monetary policy framework since Uganda has a very large informal sector with limited use of banking services. There is also a very high rate of bank closure due to bankruptcy and mismanagement which has reduced the population's trust in the financial institutions. In less than decade, many banks in Uganda like Crane Bank (the most recent-2017), Global trust bank, National Bank of Commerce, Nile bank, Green land bank exited the economy or merged with other banks and while other banks like Barclays Bank Uganda are not so sure of their position after Barclays Bank PLC London announced in 2016 its plan to exit the African market. The Central Bank has a lot to do in terms of regulating the commercial banks in Uganda if inflation targeting is to be implemented efficiently. The Central Bank may have to declare and regulate Mobile money services as financial institutions which are directly affected by the inter-bank rate since majority of Ugandans use the services. Statistics show that on average every Ugandan who owns a mobile phone also has access to mobile money services.

Inflation resulting from supply side(shocks)

Uganda's economy is mainly agricultural, landlocked and less industrialized which makes it more prone to supply shocks like rise in fuel prices, high transportation costs, deforestation, poor crop harvests, droughts, pests and diseases which lead to high food prices among others. The hyperinflation that affected Uganda in 2011 was attributed to very high fuel prices and poor crop harvests which means headline inflation is a more significant impact on the economy than core inflation. When calculating and setting inflation targets during the inflation lite regime, core inflation is considered instead of headline inflation (Mutebile,2012). This means that in the bid to capture and control inflation in Uganda, the central bank is avoiding the real problem. Controlling core inflation may make the economy seem more stable than it is and may attract investors but may not help to bring about economic growth and improve the standards of living of the Ugandans. I would recommend the central bank to focus on the headline inflation instead of core inflation just like South Africa and Ghana that have adopted full-fledged inflation.

Focusing on core inflation instead of headline inflation.

Core inflation is a measure of inflation derived from a basket that excludes food crops, fuel, energy and utilities while headline inflation is a measure of inflation that includes all items in a consumer basket (Mutebile 2014). In his presentation, the governor Bank of Uganda (Mutebile 2014) clearly states that when setting the inflation target, the central bank focuses on core inflation instead of headline inflation and the reason for this is that there is potentially better control over core inflation than headline inflation. Mutebile,2014 further notes that the goods and services whose prices are excluded from core inflation are generally more volatile and more subject to supply price shocks than the other prices in the consumer basket. It should be noted that the secondary objective of inflation targeting in Uganda is to improve economic growth and reduce poverty amongst the people (Mutebile,2012), so if headline inflation which affects the masses directly is ignored then this objective cannot be achieved. An average Ugandan will greatly feel the impact of increase in food prices like the most previous rise in sugar prices (May,2017) than the increase in the prices of the construction materials. South Africa a full-fledged inflation targeting African country has embarked on controlling headline inflation rather than core inflation (Kumo,2015) and the results are very impressive.

External factors.

Inflation in Uganda has also been caused by external factors like imported inflation and depreciation of Uganda's currency against other foreign currencies which the central bank or the inter-bank rate cannot control. Uganda imports almost 75% of the goods used ranging from food stuff, petroleum products, vehicles, clothing, chemicals among others. The major currency used for imports is the United States' dollar and appreciation of the dollar poses great danger to the economy and in a worst-case scenario may result into dollarization. The Central bank's efforts to control such inflation may be hard to realize since and hence pursuing full-fledged inflation may be hard to achieve.

SECTION 7:

CONCLUSION.

This study focused on analysing the effect of inflation targeting on inflation and inflation volatility in Uganda and other African countries (South Africa, Kenya and Ghana). First, Uganda, South Africa, Kenya and Ghana's inflation volatility was estimated using a GARCH (1,1) model and later comparison of the countries' inflation rates was made from 1992 to 2016.

The results in this study indicate that inflation targeting lite reduced Uganda's inflation rate (currently 6.8%) and inflation volatility although still relatively higher than South Africa's inflation (currently 6.0%) and inflation volatility which adopted a full-fledged inflation targeting framework in 2000. The results also showed that South Africa has the lowest inflation (6%) and inflation volatility in comparison with Uganda (6.8%), Kenya (9.12%) and Ghana (12.8%). Ghana has a relatively high inflation and inflation volatility in comparison with South Africa (a full-fledged economy), Uganda (inflation targeting lite economy) and Kenya. Kenya that adopted a forward looking monetary policy instead of inflation targeting. Kenya had the highest inflation rate and volatility than Uganda and South Africa until 2013 when Ghana surpassed it. It is also observed that all the four countries experienced higher and more volatile inflation during the periods when money growth targeting was the monetary framework used to control inflation rates and volatility.

From these results, we can conclude that full-fledge inflation targeting economies with less supply shocks like South Africa have lower inflation volatility than transitional economies like Uganda. Secondly, frequent supply shocks may render full-fledged inflation targeting less effective in controlling inflation and inflation volatility just the case with Ghana. Thirdly, forward-looking monetary policy may be as good as any other monetary policy framework in controlling inflation and inflation volatility in case of persistent supply shocks. Lastly this study shows that money growth targeting is a less effective monetary policy than inflation targeting (regardless of the regime) and a forward looking monetary policy in controlling inflation and inflation volatility.

REFERENCE

Alper, C E. Morales, A. and Yang, F. (2016) “Monetary policy implementation and volatility transmission along the yield curve: The case of Kenya” IMF working paper 16/120, African Department.

Andersson, N G F and Jonung L, (2017) “How tolerant should Inflation targeting Central banks be? -Selecting the proper tolerance band-Lessons from Sweden”, Working paper 2017:2, School of Economics and Management, Lund University.

Andrle, M.A., Berg, A., Morales, A.R., Portillo, A., and Vlcek, J. (2013) “Forecasting and Policy Analysis Systems in Low Income Countries: The Role of Money Targeting in Kenya”, *International Monetary Fund Working Paper*, Washington, D.C.

Back to Basics, (June 2003) “The move to Inflation targeting”, IMF working paper, Finance and Development, pp 24-25

Bank of Uganda, (2011) “Understanding the inflation targeting-Lite policy framework” [https://www.bou.or.ug/bou/boudownloads/publications/special_pubs/2011/All/Inflation Targeting-Lite Policy Framework.pdf](https://www.bou.or.ug/bou/boudownloads/publications/special_pubs/2011/All/Inflation_Targeting-Lite_Policy_Framework.pdf) (Accessed on 2017/05/30)

Barro, J R. (1995) “Inflation and Economic growth”, NBER Working Paper 5326, Cambridge, MA 02138, October 1995.

Bernanke, S.B. and Mishkin, S.F. (2015) “A framework for monetary policy” *The Journal of Economic Perspectives* 11, pp 97-116.

Bollerslev, T. (1986) “Generalized Autoregressive Conditional Heteroskedasticity” University of California at San Diego, La Jolla, CA 92093, USA. Institute of Economics, University of Aarhus, Denmark.

Carare, A. Stone, R.M. (2003) “Inflation Targeting Regime” IMF working paper, Monetary and Exchange Department.

Daily Monitor, 14/10/2011 “Causes of inflation and possible solutions.”

Dong, H. and Nabbosa, O. (2017) “Review and extension of TSE 1998’s paper on Conditional Heteroscedasticity of the Yen-Dollar exchange rate” *Time Series Assignment No. 2*, March 2017.

Enders, W. (2010) *Applied Econometric Time Series*. John Wiley & Sons.

Engel, R. F. (1982) “Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation”, *Econometrica*, Vol 50, No. 4. 987-1008, July 1982.

Fischer, S. (1993) “The Role of Macroeconomic Factors in Growth”, *Journal of Monetary Economics*, Vol. 47, No. 5, pp. 485-512.

Fosu, N K. (2015) “Inflation targeting: The Ghanaian Experience”, University of Ghana.

Ghosh, A. and Phillips, S. (1998) “Warning: Inflation May Be Harmful to Your Growth”, IMF working Papers, Vol. 45, No. 4, pp. 672-710.

Hammond, G. (2012) “State of the art of inflation targeting. Centre for Central Banking Studies” Handbook No. 29 – February 2012 version; London: Bank of England.

International Monetary Fund(IMF), “World Economic outlook” September 2005.

Jahan, S. (2012), Inflation targeting; “Holding the line” IMF working paper, Finance and Development.

Kasidi, F. and Mwanemela, K. (2013) “Impact of inflation on economic growth a case study of Tanzania”, Asian Journal of Empirical research, 3(4), pp 363-380.

Kumo, L.W. (2015) Inflation Targeting Monetary Policy, “Inflation Volatility and Economic Growth in South Africa”, Working Paper Series N° 216 African Development Bank, Tunis, Tunisia.

Laurens, B J. Eckhold, K. King, D. Maehle, N. Naseer, A. and Duree´, A. (2015) “The journey to inflation targeting: Easier said than done” The case for Transitional Arrangements along the road, IMF working paper 15/136, Monetary and capital markets Department.

Lin, S. and Ye, H. (2009) “Does Inflation targeting make a difference in developing countries?”, Journal of Development Economics, volume 89, Issue 1, pp 118-123.

Mallik, G. and Chowdhury, A. (2001) “Inflation and Economic Growth: Evidence from Four South Asian Countries”, *Asian Pacific Development Journal*, Vol. 8, No. 1, pp. 123-135.

Masson, R.P. Savastona, A.M. and Sharma, S. (1997) “The Scope of Inflation Targeting in Developing countries, Working paper of the International Monetary Fund.

Mishkin, S.F. (2004) “Can inflation targeting work in emerging market countries?” National Bureau of Economic Research (NBER) working paper 10646

Mugume, A. (2011) “Inflation targeting as a framework for maintaining price stability”, The inflation targeting monetary policy framework seminar for business editors and reporters, Grand Imperial Hotel, June 23, 2011.

Mugume, A. and Namanya, C.R.A. (2014) “The Augmented Taylor Rule and setting of Monetary Policy Rates in a Developing and Small Open Economies: Bank of Uganda’s Experience” working paper 08/2014, Bank of Uganda September 2014.

Mundell, R. (1963) “Inflation and Real Interest”, *The Journal of Political Economy*, vol. 71, No.3, pp.280-283.

Musinguzi, P. and Katarikawe, M. (2000) “Monetary Policy Frameworks in Africa: The Case of Uganda”, BoU Working paper.

Mutebile, E T. (2012) “Basic principles guiding monetary policy in Uganda”, Annual dinner of Uganda’s Bankers’ Association, 30 November 2012.

Mutebile, E T. (2014) “The elements of a modern monetary policy framework- Transition to modern monetary policy frameworks in low income countries”, IMF-Bank of Uganda Conference, 17 March 2014.

Nyorekwa, E T. and Odhiambo, N M. (2014) “Monetary policy and economic growth dynamics in Uganda”, *Banks and Bank systems*, volume 9, issue 2, pp 18-28.

Roger, S. (2010) “Inflation targeting turns 20”, *Finance and development*, volume 47, Number 1.

Rother, P.C, (2004) “Fiscal Policy and Inflation Volatility”, *Working Paper Series No. 317 / March 2004*, European Central Bank.

Rotich, H. Kathanje, M. and Maana, I. (2007) “A monetary policy reaction function for Kenya”, Annual African Econometric society in Pretoria, South Africa, 13 July 2008.

Svensson, E.O. L. (1998) “Inflation targeting as a monetary policy rule” Institute for International Economic Studies, Stockholm University; CEPR and NBER

Taylor, S.J, (2005) “Asset price dynamics, volatility and prediction”, Princeton University Press. Princeton, New Jersey.

Tobin, J. (1965). “Money and Economic Growth”, *Econometrica*, Vol.33, pp. 671-684.

Uwilingiye, J. (2010) “Evaluating the inflation targeting regime of South Africa”, University of Pretoria.

Vavra, J.S, (2103) “Inflation Dynamics and Time-Varying Volatility: New Evidence and an SS Interpretation”, *NBER Working Paper Series Working Paper 19148*, National Bureau of Economic Research, Cambridge, Ma 02138 June 2013.

Zivot, E. (2009) “Practical issues in the analysis of univariate GARCH models”, *Handbook of Financial Time Series*, pp 113-155.

APPENDIX A

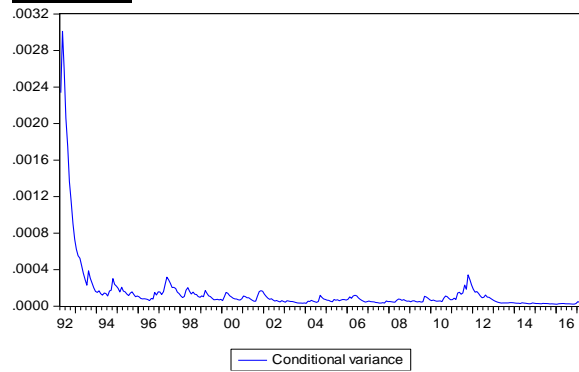
Country	Inflation targeting adoption date	Inflation rate at adoption date (percent)	2010 end-of-year inflation (percent)	Target inflation rate (percent)
New Zealand	1990	3.30	4.03	1 – 3
Canada	1991	6.90	2.23	2 +/- 1
United Kingdom	1992	4.00	3.39	2
Australia	1993	2.00	2.65	2 – 3
Sweden	1993	1.80	2.10	2
Czech Republic	1997	6.80	2.00	3 +/- 1
Israel	1997	8.10	2.62	2 +/- 1
Poland	1998	10.60	3.10	2.5 +/- 1
Brazil	1999	3.30	5.91	4.5 +/- 1
Chile	1999	3.20	2.97	3 +/- 1
Colombia	1999	9.30	3.17	2 – 4
South Africa	2000	2.60	3.50	3 – 6
Thailand	2000	0.80	3.05	0.5 – 3
Hungary	2001	10.80	4.20	3 +/- 1
Mexico	2001	9.00	4.40	3 +/- 1
Iceland	2001	4.10	2.37	2.5 +/- 1.5
Korea	2001	2.90	3.51	3 +/- 1
Norway	2001	3.60	2.76	2.5 +/- 1
Peru	2002	-0.10	2.08	2 +/- 1
Philippines	2002	4.50	3.00	4 +/- 1
Guatemala	2005	9.20	5.39	5 +/- 1
Indonesia	2005	7.40	6.96	5 +/- 1
Romania	2005	9.30	8.00	3 +/- 1
Ghana	2007	10.50	8.58	8.5 +/- 2
Albania	2009	3.70	3.40	3 +/- 1

Source: Scott Roger (March 2010)- “Inflation Targeting Turns 20” Volume 47

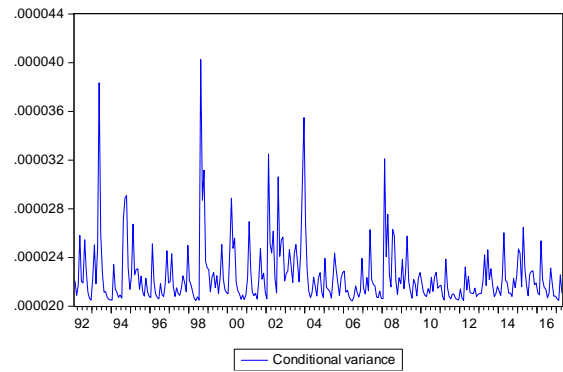
APPENDIX B

INDIVIDUAL CONDITIONAL VARIANCE OF THE MONTHLY LOG-INFLATION

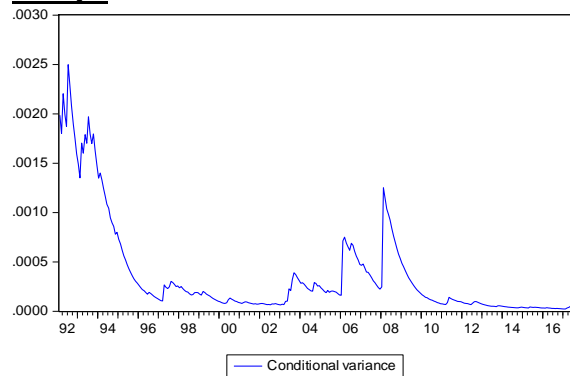
Uganda



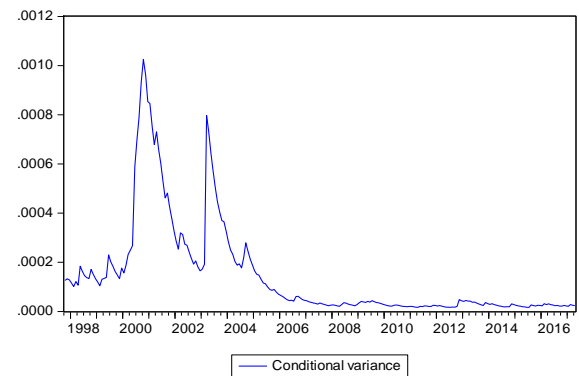
South Africa



Kenya



Ghana



Source: E-views.

APPENDIX C

Economic Indicator

Indicator: CPI, Standardized, Index, 2010=100

PERIOD	SOUTH AFRICA	KENYA	GHANA	UGANDA
2017-03-31	144,678845	172,192161	222,170669	162,633
2017-02-28	143,8302887	169,36903	219,230978	163,011
2017-01-31	142,2746022	166,498847	217,27058	161,693
2016-12-31	141,426046	164,852021	216,840786	161,204
2016-11-30	140,8603418	163,600433	214,115964	158,58
2016-10-31	140,4360636	162,442949	211,314841	156,67
2016-09-30	139,7289334	161,445443	210,383408	156,163
2016-08-31	139,4460813	160,890227	207,338826	155,589
2016-07-31	139,5875074	160,767892	204,895482	155,13
2016-06-30	138,456099	159,751564	203,777736	154,9
2016-05-31	137,7489688	158,085917	201,660741	153,611
2016-04-30	137,4661167	157,220157	198,848987	152,765
2016-03-31	136,3347083	156,137957	196,777446	152,694
2016-02-29	135,344726	155,328659	193,405427	152,604
2016-01-31	133,5061874	155,620383	191,516035	152,504
2015-12-31	132,5162051	155,008705	187,749289	152,59
2015-11-30	132,0919269	153,361878	185,22691	151,659
2015-10-31	131,9505009	152,571402	182,532267	150,52
2015-09-30	131,6676488	151,818567	179,505794	149,453
2015-08-31	131,6676488	151,413918	177,194167	148,07
2015-07-31	131,6676488	151,103374	175,395822	147,31
2015-06-30	130,2533883	150,999859	171,893217	146,139
2015-05-31	129,6876841	150,548158	169,583589	145,962
2015-04-30	129,4048321	149,343622	167,469597	145,499
2015-03-31	128,2734237	146,671058	165,258711	143,84
2015-02-28	126,4348851	145,052463	163,384303	142,657
2015-01-31	125,7277549	144,384322	161,263075	142,221
2014-12-31	125,8691809	143,518562	159,696705	140,894
2014-11-30	126,152033	142,897473	157,918954	140,573
2014-10-31	126,152033	142,963346	155,953431	140,16
2014-09-30	125,8691809	143,26448	152,700956	140,512
2014-08-31	125,8691809	143,057451	150,541594	140,419
2014-07-31	125,4449028	141,721169	148,300922	139,927
2014-06-30	124,4549204	141,071849	146,361145	139,301
2014-05-31	124,0306423	140,87423	144,617342	139,058
2014-04-30	123,8892163	139,462664	143,446101	138,904

2014-03-31	123,3235121	137,966405	141,815331	139,22
2014-02-28	121,6263995	137,345316	140,582855	138,18
2014-01-31	120,3535651	136,827742	139,054283	138,037
2013-12-31	119,5050088	135,369124	136,657472	137,901
2013-11-30	119,2221567	134,700983	135,182236	137,556
2013-10-31	119,0807307	134,333976	133,735689	137,555
2013-09-30	118,7978786	134,399849	130,926265	137,482
2013-08-31	118,2321744	132,019009	129,439396	137,694
2013-07-31	117,9493223	131,623771	128,1933	136,255
2013-06-30	116,6764879	131,360279	126,951836	136,17
2013-05-31	116,3936358	131,294405	125,687985	134,758
2013-04-30	116,6764879	131,068555	125,133484	133,31
2013-03-31	116,2522098	129,826377	123,982849	132,64
2013-02-28	114,8379493	128,537148	123,452546	132,269
2013-01-31	113,706541	127,624335	122,730509	131,599
2012-12-31	113,4236889	126,335106	122,44217	131,258
2012-11-30	113,1408368	125,469346	121,688871	130,508
2012-10-31	112,8579847	124,650638	120,726661	129,302
2012-09-30	112,1508544	124,114243	121,307431	127,963
2012-08-31	111,1608721	123,756646	120,780084	128,537
2012-07-31	110,87802	124,142474	119,89779	127,828
2012-06-30	110,5951679	125,215264	119,19093	129,173
2012-05-31	110,1708898	126,184539	118,292229	129,932
2012-04-30	110,1708898	125,855173	116,675498	129,519
2012-03-31	109,7466117	124,69769	115,598581	128,973
2012-02-29	108,4737773	123,050863	114,364543	129,365
2012-01-31	107,9080731	123,107326	113,271781	126,855
2011-12-31	107,3423689	122,420364	112,682813	125,583
2011-11-30	107,2009428	121,516962	111,742146	124,532
2011-10-31	106,7766647	119,700748	110,986657	123,467
2011-09-30	106,3523866	117,846892	110,638697	121,632
2011-08-31	105,9281084	116,661177	109,900955	117,057
2011-07-31	105,6452563	115,221381	108,93956	116,109
2011-06-30	104,7967001	113,781584	108,247261	112,623
2011-05-31	104,3724219	112,435891	107,776593	110,374
2011-04-30	103,9481438	111,316049	106,920092	109,071
2011-03-31	103,5238656	107,862419	106,495923	106,997
2011-02-28	102,2510312	105,453348	105,683678	104,158
2011-01-31	101,685327	104,051193	104,703658	103,283
2010-12-31	101,1196229	102,931351	103,846557	101,482
2010-11-30	100,9781968	101,500965	103,220384	100,069
2010-10-31	100,8367708	100,663436	102,619181	99,55
2010-09-30	100,5539187	100,446996	101,791911	99,29
2010-08-31	100,5539187	99,9858843	101,071529	99,614

2010-07-31	100,5539187	99,7318026	100,245453	100,617
2010-06-30	99,84678845	99,3836164	99,329013	98,547
2010-05-31	99,84678845	99,5530043	98,6250549	97,727
2010-04-30	99,56393636	99,3365642	98,1350287	97,995
2010-03-31	99,42251031	98,7813485	97,789639	98,222
2010-02-28	98,71538008	98,9789677	97,1117977	98,246
2010-01-31	98,00824985	98,706065	96,2144515	98,151
2009-12-31	97,72539776	98,489625	95,4293465	98,573
2009-11-30	97,58397171	97,7462005	94,4625263	98,471
2009-10-31	97,58397171	97,5674022	93,7247833	98,04
2009-09-30	97,58397171	97,3227309	92,9781781	97,959
2009-08-31	97,01826753	96,87103	92,4386116	96,643
2009-07-31	96,87684148	96,2969934	91,7960816	94,288
2009-06-30	95,88685916	96,0335012	90,9443002	94,488
2009-05-31	95,32115498	95,835882	89,1931324	93,68
2009-04-30	95,03830289	95,835882	87,9066833	92,488
2009-03-31	94,61402475	95,0077636	86,2926463	91,543
2009-02-28	93,34119034	94,1043617	84,9924083	91,184
2009-01-31	92,35120801	93,1633181	83,7554116	90,015
2008-12-31	91,92692988	93,5115545	82,1418403	88,683
2008-11-30	92,06835592	93,0974543	80,5384267	88,108
2008-10-31	91,92692988	91,5071534	79,1191927	87
2008-09-30	91,92692988	91,1871532	78,3614402	86,15
2008-08-31	91,36122569	90,2367526	77,3030509	85,926
2008-07-31	90,79552151	88,8063518	76,308938	84,603
2008-06-30	89,66411314	88,4299516	75,5351043	83,897
2008-05-31	88,39127873	87,432451	74,4649155	82,817
2008-04-30	87,6841485	85,2491497	73,0055102	81,426
2008-03-31	87,25987036	82,9059484	71,6250973	80,03
2008-02-29	85,98703595	82,0496479	70,6917662	79,26
2008-01-31	85,42133176	82,284948	69,9172744	78,469
2007-12-31	83,86564526	73,729543	69,407561	77,652
2007-11-30	83,29994107	71,7218418	68,3220818	76,712
2007-10-31	82,87566293	70,7103412	67,1791233	76,11
2007-09-30	82,1685327	70,1477409	66,4127522	74,782
2007-08-31	81,60282852	69,4190405	65,6561471	74,392
2007-07-31	81,17855038	69,6588406	64,7886807	74,573
2007-06-30	80,47142015	69,1546403	63,9793825	74,503
2007-05-31	79,76428992	68,2015398	63,8201801	74,079
2007-04-30	79,34001179	68,4413399	63,2288569	74,077
2007-03-31	78,20860342	69,2684404	62,8288408	73,705
2007-02-28	77,64289923	68,7426401	62,418619	73,761
2007-01-31	77,64289923	67,8603396	61,9860087	73,789
2006-12-31	77,07719505	65,8096384	61,5043761	73,681

2006-11-30	76,65291691	64,1340374	61,1790139	72,66
2006-10-31	76,79434296	63,9618373	60,8254405	71,715
2006-09-30	76,65291691	62,7873366	60,1579972	71,323
2006-08-31	76,37006482	61,778936	59,4964816	71,127
2006-07-31	75,80436064	61,3423358	59,3523867	70,765
2006-06-30	75,09723041	62,2432363	57,9261096	70,484
2006-05-31	74,53152622	64,1401374	57,4931612	70,064
2006-04-30	74,10724808	64,7765378	57,3023401	69,044
2006-03-31	73,68296995	65,4253382	56,9377155	69,57
2006-02-28	73,40011786	64,3584375	56,4296486	68,174
2006-01-31	73,25869181	61,8742361	55,8161626	67,585
2005-12-31	72,83441367	56,9335332	55,5064648	66,235
2005-11-30	72,83441367	55,9435326	55,2073777	66,574
2005-10-31	72,83441367	55,2886323	54,7665864	66,674
2005-09-30	72,83441367	55,1503322	54,1409478	66,866
2005-08-31	72,41013553	55,4055323	53,0056322	65,845
2005-07-31	72,26870949	55,6914325	52,8505053	66,15
2005-06-30	71,56157926	56,1126327	52,1058704	65,698
2005-05-31	71,7030053	56,7183331	51,3858833	65,991
2005-04-30	71,7030053	56,4016329	51,3245856	65,962
2005-03-31	71,27872717	54,913632	50,6446777	64,743
2005-02-28	70,71302298	54,1419316	49,9147113	64,124
2005-01-31	70,57159694	53,6223313	49,9217037	63,735
2004-12-31	70,28874484	52,9305309	49,0395282	63,878
2004-11-30	70,43017089	52,7553308	48,448882	63,229
2004-10-31	70,1473188	53,3056311	47,7840405	62,482
2004-09-30	69,86446671	52,8936309	47,3988751	62,035
2004-08-31	69,86446671	51,8421302	46,8002235	61,802
2004-07-31	69,86446671	49,8283291	45,0955017	60,238
2004-06-30	69,58161461	50,1389292	45,6361123	59,36
2004-05-31	69,44018857	49,4164288	44,8147227	59,189
2004-04-30	69,44018857	48,6139284	43,6786664	58,693
2004-03-31	69,29876252	48,1066281	42,8356388	58,507
2004-02-29	68,87448438	47,5194277	42,4713748	58,829
2004-01-31	68,45020625	46,6801272	42,4857719	58,871
2003-12-31	67,88450206	45,5302266	42,200886	59,287
2003-11-30	67,88450206	45,2258264	41,7714658	59,038
2003-10-31	68,45020625	45,0629263	41,0529511	59,094
2003-09-30	68,87448438	44,4634259	39,8912927	58,996
2003-08-31	69,01591043	44,7677261	39,9474	58,986
2003-07-31	68,87448438	45,9084268	39,124525	58,955
2003-06-30	68,87448438	47,3257276	38,399875	58,745
2003-05-31	69,01591043	47,2181275	37,8101957	58,404
2003-04-30	69,15733648	45,1889264	37,0594988	58,328

2003-03-31	69,01591043	44,4111259	36,8598373	57,637
2003-02-28	68,3087802	43,2581252	35,8595919	57,103
2003-01-31	68,45020625	42,7693249	33,0583675	56,452
2002-12-31	67,74307602	42,0222245	32,1245848	55,549
2002-11-30	67,74307602	41,5026242	31,3232501	55,237
2002-10-31	67,31879788	41,3120241	30,7776504	54,824
2002-09-30	66,4702416	41,210524	30,578962	53,957
2002-08-31	65,62168533	41,3489241	29,7420511	53,51
2002-07-31	65,48025928	41,3919241	29,2950608	53,304
2002-06-30	64,34885091	41,6071243	28,7854451	53,529
2002-05-31	63,92457278	41,090624	28,6712145	53,146
2002-04-30	63,50029464	40,4788236	28,8165487	52,896
2002-03-31	62,65173836	40,3282235	28,5620119	53,175
2002-02-28	61,94460813	40,2605235	28,7279849	53,152
2002-01-31	61,37890395	40,2082235	29,2339162	52,755
2001-12-31	60,24749558	40,3097235	28,8397085	52,494
2001-11-30	59,96464349	40,4604236	28,5583738	52,323
2001-10-31	59,6817914	40,5526237	28,2913264	52,707
2001-09-30	59,6817914	40,4911236	27,803279	53,248
2001-08-31	59,54036535	40,6141237	27,691584	54,052
2001-07-31	59,6817914	40,5218236	28,0947659	54,797
2001-06-30	59,6817914	40,4604236	27,6883419	54,873
2001-05-31	59,3989393	40,3989236	27,3447819	54,515
2001-04-30	59,25751326	40,1222234	26,6526372	54,415
2001-03-31	58,83323512	39,5380231	26,0391243	54,297
2001-02-28	58,55038303	39,7840232	24,925846	54,56
2001-01-31	58,40895698	40,0299234	24,3351838	54,613
2000-12-31	57,56040071	39,6610231	23,8298668	54,85
2000-11-30	57,56040071	39,5995231	22,919901	55,433
2000-10-31	57,41897466	39,2920229	22,4267037	54,495
2000-09-30	57,13612257	39,2920229	21,687488	53,84
2000-08-31	56,99469652	39,0461228	20,6004043	53,235
2000-07-31	56,71184443	38,8924227	19,5017814	52,537
2000-06-30	56,28756629	38,6772226	18,5763564	51,918
2000-05-31	55,86328816	37,785522	17,692239	51,929
2000-04-30	55,58043606	36,8017215	16,6014872	52,026
2000-03-31	54,87330583	36,1253211	16,105704	51,892
2000-02-29	54,30760165	36,1253211	15,6306852	51,081
2000-01-31	54,59045374	35,7564209	15,1131695	51,812
1999-12-31	53,88332351	35,4797207	14,6569457	52,445
1999-11-30	53,74189747	35,4797207	14,4437582	52,228
1999-10-31	53,60047142	35,2952206	13,9842787	52,476
1999-09-30	53,45904537	35,2030205	13,7688897	52,538
1999-08-31	53,31761933	35,0800205	13,5309106	51,794

1999-07-31	53,45904537	34,8955204	13,3398992	51,075
1999-06-30	53,45904537	34,7725203	13,2998988	50,776
1999-05-31	53,17619328	34,8033203	13,1963573	50,437
1999-04-30	53,17619328	34,31142	13,4484067	50,608
1999-03-31	53,03476724	34,0962199	13,4806781	50,43
1999-02-28	53,03476724	33,5735196	13,5071544	50,381
1999-01-31	53,03476724	32,589619	13,6046547	49,026
1998-12-31	52,75191514	32,1285187	13,4552514	48,395
1998-11-30	52,75191514	32,0670187	13,37282	47,482
1998-10-31	52,75191514	32,2515188	13,2742624	47,626
1998-09-30	52,46906305	32,497419	13,1665866	47,554
1998-08-31	51,62050678	32,8971192	13,3017143	47,836
1998-07-31	51,05480259	33,1431193	13,298199	47,898
1998-06-30	49,92339423	33,1123193	13,2770419	48,428
1998-05-31	49,64054213	32,8971192	13,207343	48,344
1998-04-30	49,49911609	33,0816193	13,1113299	48,252
1998-03-31	49,216264	33,1123193	12,6303618	48,924
1998-02-28	48,9334119	33,0816193	12,5034892	49,765
1998-01-31	48,79198586	32,7434191	12,1740202	50,165
1997-12-31	48,36770772	31,9133186	12,0533721	49,709
1997-11-30	48,22628167	31,4828184	11,8735502	49,379
1997-10-31	48,36770772	30,7450179	11,6329768	48,679
1997-09-30	48,22628167	30,7050179	11,6636868	48,47
1997-08-31	47,80200354	30,2407176		48,85
1997-07-31	47,80200354	30,4560178		49,363
1997-06-30	47,3777254	31,1231182		48,83
1997-05-31	47,23629935	31,5351184		49,104
1997-04-30	47,09487331	31,0247181		48,144
1997-03-31	46,67059517	30,794118		46,642
1997-02-28	46,38774308	29,3245171		45,239
1997-01-31	46,10489098	28,9126169		45,817
1996-12-31	45,5391868	28,6328167		45,734
1996-11-30	45,11490866	28,4312166		46,088
1996-10-31	44,97348262	28,3732166		46,699
1996-09-30	44,40777843	28,3109165		46,402
1996-08-31	43,98350029	28,1692164		45,157
1996-07-31	43,84207425	28,0721164		44,598
1996-06-30	43,55922216	27,6930162		43,772
1996-05-31	43,13494402	26,9971157		43,498
1996-04-30	42,85209193	26,8137156		43,587
1996-03-31	42,56923984	26,7195156		43,703
1996-02-29	42,28638774	26,2974153		43,891
1996-01-31	42,1449617	26,1749153		43,315
1995-12-31	41,57925751	25,8736151		43,181

1995-11-30	41,43783147	25,5642149		43,312
1995-10-31	41,15497938	25,638715		42,559
1995-09-30	41,01355333	25,680715		42,238
1995-08-31	41,01355333	25,4110148		41,914
1995-07-31	40,87212728	25,2766147		41,07
1995-06-30	40,73070124	25,2689147		41,549
1995-05-31	40,73070124	25,2315147		41,036
1995-04-30	40,58927519	25,0200146		41,069
1995-03-31	40,16499705	25,1151147		41,339
1995-02-28	39,74071892	24,9698146		41,135
1995-01-31	39,45786682	24,7093144		40,053
1994-12-31	38,89216264	24,2058141		39,877
1994-11-30	38,89216264	24,2186141		39,241
1994-10-31	38,75073659	24,8195145		38,552
1994-09-30	38,60931055	24,6913144		38,305
1994-08-31	38,04360636	25,0760146		39,282
1994-07-31	37,47790218	25,4141148		39,679
1994-06-30	36,912198	25,2306147		40,301
1994-05-31	36,77077195	25,706915		40,135
1994-04-30	36,48791986	25,9712151		39,483
1994-03-31	36,34649381	25,2930148		38,653
1994-02-28	36,06364172	24,6229144		38,141
1994-01-31	35,92221567	23,8604139		38,04
1993-12-31	35,49793754	22,7046132		37,231
1993-11-30	35,35651149	22,342113		36,649
1993-10-31	35,21508544	22,1048129		36,601
1993-09-30	35,0736594	21,8803128		36,492
1993-08-31	34,93223335	20,642412		36,044
1993-07-31	34,64938126	19,9561116		35,93
1993-06-30	34,50795522	19,5974114		34,55
1993-05-31	34,22510312	18,2158106		34,391
1993-04-30	34,08367708	17,5780103		34,362
1993-03-31	33,37654685	16,4573096		34,469
1993-02-28	32,95226871	15,9534093		34,757
1993-01-31	32,81084266	14,7704086		35,371
1992-12-31	32,38656453	14,6766086		35,861
1992-11-30	32,38656453	14,2630083		36,271
1992-10-31	32,24513848	14,0435082		36,512
1992-09-30	32,10371243	14,2154083		36,2
1992-08-31	31,96228639	13,9789082		36,817
1992-07-31	31,6794343	13,9229081		36,592
1992-06-30	31,25515616	14,0868082		35,409
1992-05-31	30,97230407	12,7742075		34,734
1992-04-30	30,83087802	12,3691072		33,303

1992-03-31	30,40659988	12,2689072	30,536
------------	-------------	------------	--------

Source: Thomson Reuters Data

