Kabale University Interdisciplinary Research Journal (KURJ)

OPEN ACCESS

Analysis of viability of core inflation components based on excluded items in Uganda

***Munyambonera Ezra**[1], **Mukiza Chris Ndatira**[2] and **Niyimpa Ediga Mfite**[2]

[1]Kabale University, Uganda

[2]Uganda Bureau of Statistics

*Corresponding Author
emunyambonera@kab.ac.ug

KURJ
ISSN 2790-1394

pp. 51 - 76
Vol 2. Issue 2.
Oct 2023

ABSTRACT

The motivation behind this study was to investigate the viability of core inflation components based on traditionally excluded items of the consumer price index in Uganda. Particularly, this was achieved through subjecting all Energy, Fuel and Utilities (E,FU) and Food crops to volatility and persistence tests. The study used time series data obtained from the Uganda Bureau of Statistics (UBOS) for the period July 2010 to June 2017 and covered all the 10 baskets monitored by UBOS. The measurement variables included volatility and persistence. In this paper, the sum of the coefficients of an AR (q) model is used as a measure of persistence. In the study, food and related items are noted to be more volatile than EFU items. Particularly tobacco leaves, peas, matooke and malewa recorded the highest volatility with a low persistence while cassava fresh, water melons, apples, ground nuts and french beans recorded the least price volatility during the study period. On the other hand, the EFU items namely petrol, diesel, paraffin, Uganda National Water (UNW), firewood and electricity recorded the least variation in prices with a high persistence during the study period. The study further indicated that inclusion of the EFU and food items found to be less volatile and highly persistent, did not yield significantly different results when comparing means of the recompiled and existing core index at 5 percent level of significance. However, the recompiled core index was more precise than the existing core index because the standard error was reduced by 7 percent. In light of the findings, this study recommends a periodical review of the core inflation components based on both volatility and persistence in order to improve estimates.

Keywords: *Inflation, Volatility, Persistence*

Introduction

Background to the Study

Economists and policy makers around the world are concerned about inflationary process because inflation influences economic activities in a number of ways. It directly affects the real rate of returns and expected rate of future inflation that influences the cost of living, increase in wages, grants, agreements and long-term contracts (Aron *et al.*, 2015). It also plays a critical role in policy-making; particularly among countries that targets inflationary trends, and where the central banks are explicitly responsible for anchoring price levels.

Inflation refers to the persistent rise in the general level of prices for goods and services within the economy over a period of time. Inflation rate is derived from consumer price index (CPI) and therefore categorized as; Headline inflation which is the overall inflation, Energy Fuel and Utility inflation, Food (food crops and manufactured food) inflation, Core inflation, depending on the basket of goods considered (UBOS, 2012).

There is emprical evidence that nations have developed different centers and approaches to compute Consumer Price Indices (CPIs) without / few explanations why some items are termed as core inflation components while others are excluded United Nations. (2013). Yet, some of the core inflation components do not necessarily portray final monetary household expenditure (consumption) and some that are excluded seem not to be volatile. This contravenes the principle that for an item to be a core component, it should be less volatile. Kaplan and Price (2015) noted that in USA, CPI covers the consumption sector of the economy and excludes investment items such as stocks, bonds, real estate and business expenses. Life insurance also is excluded; although health, household and vehicle insurance are in the scope. Employer provided in-kind benefits are seen as part of income and therefore included. Purchases of houses, antiques and collectibles are viewed as investment expenditures and therefore excluded. Gambling losses, fines, cash gifts to individuals or charities, child support and allowance payments and changes in interest costs or interest rates are also excluded from the CPI scope. Although some have been in the CPI for many years in the US; and for practical reasons, the CPI excludes illegal goods and services and the value of home-produced items other than owners' equivalent rent.

Although food is considered volatile, it is highly consumed by households across the nation. Like other nations, Uganda has divided food into two: crop and manufactured foods. The manufactured foods are included while food crops are excluded. The second component is fuel and electricity which is mostly used by households for lighting and transport but is excluded. Although not consumed by all households in Uganda, the price of gas is stable yet excluded (UBOS, 2016).

This study therefore investigated the viability analysis of core inflation components with a focus on excluded items such as food crops, fuel, energy and utilities in Uganda. While compiling the CPI and determining core-inflation, economists exclude certain items, basing on predetermined international standards despite being less or not volatile in certain periods.

Study Motivation

Although there are many core inflationary measures, no single concept or approach exists despite the general agreement among economists that core inflation should reflect part of the inflation that is relevant to monetary authorities (IMF, 2015). Nícias and Figueiredo (2014) explain how some items show high persistence, and the extent to which they are excluded despite having great significance in predicting the nature of inflation and future trends. The non-equivalence between volatility and (the lack of) persistence implies that when an item is excluded, relevant information is likely to be lost.

In Uganda, Core Index compilation excludes various items, which raises questions about circumstances under which that takes place. Further, it remains questionable whether or not price volatility and persistence of all items would remain the same over time. Some of the excluded items such as water, electricity and gas are presumed to be relatively stable over a period of time due to the fact that their

prices are pre-determined by regulatory government authorities such as Electricity Regulatory Authority (ERA) and National water and sewerage corporation (NWSC). The study therefore simultaneously used both volatility and persistence as suggested by Nícias and Figueiredo (2014) to validate excluded items and detail how such items can be used to explain future trends in Uganda.

Objectives of the Study

The general objective of the study was to determine the viability of excluded items from core inflation components using the Consumer Price Index (CPI) in Uganda.

i. The specific objectives included the following:
ii. To validate the reliability of excluded items (food crops, EFU) from core-inflation components.
iii. To recompile core index and inflation based on validated items.
iv. To test the difference between the existing core – index and the recompiled core–index.

Hypotheses testing

In determining the reliability of excluded items from core inflation components, the median of both volatility and persistence was used as the rejection criteria.

For volatility, the test hypothesis used is;

Ho: All items above the median are volatile
Ha: All the items above the median are not volatile

For persistence, the test hypothesis used is;

Ho: All items above the median are persistent
Ha: All the items above the median are not persistent

Significance of the Study

The study reveals the extent to which persistence is an important measure of core inflation. It is common for nations to use volatility in compiling core price index without considering its persistence, yet some items are persistently volatile. The study further reveals that volatility and persistence are good measures of inclusion or exclusion of commodities in inflation measurement. The study findings will enable policy makers especially in the Ministry of Finance and Bank of Uganda (BoU) and UBOS, to accurately and consistently compute CPI on monthly basis and compare trends of future inflation in Uganda. This study will also add on the body of knowledge in the academia and statistical experts as future references for their research and publications.

The Structure of the Paper

The study research paper is organized within five sections. The first section presents background to the study, problem statement, objectives and significance of the study. It is followed by the review of the literature which is written in line with included and excluded items. It shows how different scholars have characterized items from and as core inflation components. The literature also gives the theoretical review which guided the study. The third chapter shows methods that were used. Secondary data was obtained from UBOS and used in this study. Section four presents the findings and discussions. Finally, the summary of the findings, conclusions, recommendations.

Literature Review

Theoretical Review

The Core Inflation Concept based on Volatility and Persistence

Core inflation also known as underlying inflation refers to the persistent increase in the general price level of goods and services less food crops and EFU believed to be very volatile. It is based on core components that constitute the core basket of goods and services. These components therefore vary from one country to another depending on the nature of their economies.

In Uganda, the core basket of goods and services excludes food and related items and EFU items while other countries like United Kingdom, the core measure is premised on retail price index less mortgage interest (Bryan & Cecchetti, 1999).

Studies by other scholars indicate numerous methods for compiling core inflation as reviewed theoretically in this chapter. A study conducted in Czech Republic by (Babetskii *et. al*, 2007) revealed that raw goods and non-durables, followed by services, display smaller inflation persistence than durables and processed goods. Inflation seems to be somewhat less persistent after the adoption of inflation targeting in 1998. There is also evidence for aggregation bias, that is, aggregate inflation is found to be more persistent than the underlying detailed components. Price dispersion, as a proxy for volatility, is found to be negatively related to inflation persistence, suggesting that the higher the level of volatility, the lower persistent prices become (Babetskii *et. al*, 2007).

Over time, different measures of core inflation have emerged. However, most of them differ simply in the precise way that volatile items are treated. This is the case, for example, of the trimmed mean core, where a given percentile from each tail of the individual price distribution is excluded. In this case, instead of excluding the same items in every period of time, items to be discarded are chosen following an objective statistical criterion (large price changes are excluded). With this approach, different items are excluded at different points in time.

Nícias and Figueiredo (2014), looks at another crucial dimension in which price changes should be analyzed using persistence. If changes in the price of a given good are known to be quite persistent then those changes are likely to convey relevant information about inflationary pressures. More importantly, persistence also increases the chances of relevant second round effects. Hence, downplaying the importance of persistence is a mistake that could entail important costs to policymakers.

Despite the importance of the persistence dimension, only recently the core inflation literature has begun to pay attention to it. Indeed, Cutler (2001) seems to have been the first one to do so, inspired by the comments of Blinder (1997). More papers are those of Demarco (2004), for Malta, and Babestskii *et al* (2007), for Czech Republic among others. These papers however took into consideration calculating the core inflation using only the persistence dimension, while the volatility dimension was completely ignored.

Nícias and Figueiredo (2014), went ahead and proposed a new method for measuring core inflation, one that takes into account both persistence and volatility and tested the method by using Brazilian data

from (1999-2012) for the national consumer price index. The results show that this type of core inflation measure far outperforms measures that take into consideration volatility and persistence separately. It was also observed that volatility and persistence are weakly correlated and the relationship between the two is negative. This was confirmed by plotting a scatter plot for all the items in the consumer price index basket. The item 'tubers, roots and legumes' stood out from the scatter plot and is a good example of an item that should be excluded from a good core measure given that it is both extremely volatile and less persistent.

Furthermore, an axis was drawn hinged at median volatility and persistence, so that each item is placed where it belongs (either above or below the median). It was observed that there are items that were more volatile and more persistent and these are not good for exclusion since their exclusion may imply loss of information. These items included rice, beans and corn, poultry and eggs, fats and oils, sugar and sweets, bakery products, flour and prepared flour mixes. However, they're excluded in Brazil since they come from the food group. Nícias and Figueiredo (2014), went ahead to advocate for their inclusion into the core basket. However, Nícias and Figueiredo (2014) did not put emphasis on items that were observed to be more persistent and less volatile. The ability of these items to exhibit such characteristics was one of the major reasons that informed this study as the main items to be evaluated.

Important to note however is that, standard deviation was used to measure volatility and several methods were suggested to measure persistence but eventually the sum of the coefficients of an AR(q) model was used as a measure of persistence Nícias and Figueiredo (2014). According to Andrews and Chen (1994), this method provides the best scalar measure of persistence.

The Modified Laspeyre Theory of Price Index

According to the standard Laspeyre theory, successful calculation of CPI and predicting inflationary trends has a standardized formula which assumes that "nations have fixed weight measures that have been set for a long period of time and authorities still use them" (Yuan & Li, 2010). This standard formula is presented as;

$$CPI = \frac{\sum_{i=1}^{n} p_{it} q_{io}}{\sum_{i=1}^{n} p_{io} q_{io}} x100 \qquad (2.1)$$

Under this theoretical formula,

P_{it}= Price of an item i at current period t
P_{io}= Price of an item i at current period o (First period)
Q_{io}= Quantity of an item i at current period o (First period)

According to this formula, Q_{io} is constant and it is only P_{it} that changes. This makes it easier to compare indices since similar weights are used following set standards. It should be noted that households do not fix prices; rather they keep money to purchase various goods or items and services from the market irrespective of price changes. Further, in compiling indices, authorities do not ask households about their purchasing power or demand; rather how much is spent on different items as received from the market

is calculated (Mccully *et al.*, 2007). Such arguments among others have led to the modified laspeyre formula or equation, which assumes that items within a basket change prices and weights that results into certain inflation in accordance to the linear equation Phillip's curve. This means that the formula is accommodative and changes with the changing situation, weights and prices as presented;

$$CPI = \frac{\sum_{i=1}^{n} w_{it-1} \frac{p_{it}}{p_{it-1}}}{\sum_{i=1}^{n} w_{it-1}} \quad \text{..... (2.2)}$$

P_{it}= Price of an item i at current period t
$P_{(it-1)}$= Price of an item i at previous period t-1
$w_{(it-1)}$= Weight of an item i at previous period t-1

According to the modified formula, weights are updated in each month using current prices. Therefore, the formula assumes that at initial price index series, each item or good use w_{io} as its weight, which is a starting point or a fixed weight. In the second months, w_{io} are updated by $\frac{p_{i2}}{p_{i1}}$

In order to obtain w_{i2}, the following formula is used up to the last calculation

$$w_{i2} = w_{i2} \frac{p_{i1}}{p_{i0}} \text{..... (2.3)}$$

Under the modified laspeyre, weights and prices are updated monthly unlike the standardized and fixed basket methods.

NB: The fixed basket formula incorporates both expenditure information (prices) and the household budget (Parker *et al.*, 2012). It assumes that goods within the same basket have a certain price that is fixed. Authorities use similar prices whenever they are calculating CPI. The prices are fixed with an intention of considering the households consumption. Therefore;

$$CPI = \frac{\sum_{i=1}^{n} w_{io} \frac{p_{it}}{p_{i0}}}{\sum_{i=1}^{n} w_{io}} \quad \text{..... (2.4)}$$

In this formula; w_io=the fixed weight of item i at the first period and this is got after calculating the households' expenditure (P_{io} Q_{io}).

Empirical Literature

Excluded items from the core-inflation basket of goods and services.

Exclusion falls under three categories; permanently excluded items, excluded in a period-by-period basis and downplaying the items due to the influence of volatile items. It is important to note that economists exclude certain components by estimating unobservable rate of inflation. In a permanently excluded category, economists use a standard core measure that excludes food crops and energy from the overall CPI (Dewan & Hussein, 2003). These are excluded basing on the ground that they are volatile or sensitive to price changes. In order to understand reasons why categories of food crops and energy are

more sensitive to price changes, economists normally consider environmental factors that can devastate a year's crops, or fluctuations in oil supply from the OPEC cartel. The two items (food crops and energy) are examples of a supply shock that affect prices. Nonetheless, although prices of food crops and energy frequently increase or decrease at rapid rates, the price disturbances may not be related to a trend change in the economy's overall price level; rather, changes in food and energy prices are more likely related to temporary factors that can reverse themselves later.

There is a general belief among economists that fluctuation in energy prices reflects a change in prices overtime relative in relation to prices of other items. This means that an increase in prices of oil as an important input to other goods makes them (such as automobiles) more expensive relative to less oil-intensive goods and services (like bicycles).

The important point to note is that energy price fluctuations often result from factors other than the underlying trend increase in general prices. Since it is made an independent variable through which other goods and services depend, and the fact that nations have less or no intervention to control its influence, economists normally exclude energy basing on this fact. In fact, changes in energy prices are not necessarily a sign of inflation. Research has also shown that the inclusion of energy, oil in particular can easily distort a trend increase in general price levels (Hazrana, 2017). Therefore an attempt to measure core inflation is one of the attempts by economists to isolate what is or can happen to general prices without interruption from points in volatile energy prices.

Therefore, validation of the excluded items is expected to be persistent and with a slow based variable in relation to inflation expectations and the output gap (Cukierman *et al.*, 2008). In addition, volatile measure may not be a good estimate of validation since it is commonly used in Uganda. This therefore has been based on month to month measure of inflation as done in the Ugandan CPI.

Exclusion of volatile items in period-by-period basis through trimmed means.

The second method is to exclude what are regarded excessively volatile as they occur in CPI. Under this method, the economic rationale is that "outsized" price changes are more likely to be relative, rather than generalized inflation in a certain period. This is calculated using trimmed mean in a statistical approach. Trimmed means are constructed by first ranking items in a descending or ascending order of price changes to individual CPI components in a given period, excluding top and bottom x percent (Marques & Mota, 2000). That is, the components corresponding to x percent of total CPI weights on each side. The inflation rate is then calculated as means of the remaining price changes. Normally, the median inflation rate is trimmed at 50%, which is a limiting case of the trimmed mean (Correia, 2005).

Trimmed mean of inflation has been given different definitions and explanations as well. This study uses the term as an average rate of inflation after trimming off certain percent of distributed price changes at both sides/ends. Trimmed mean requires distribution order in price changes of CPI components for any period from lowest - highest. The x% trimmed mean rate of inflation for a period at hand is calculated by excluding x% (considering weights of components in the CPI) from top and bottom of distribution order; including weight average of unobservable prices in remaining central (100-2x) percent of the distribution. In fact, the measure is obtained by trimming an increased portion of distribution from both ends. Zero (0) percent trimmed mean reveals a conventional rate of inflation. The median or 50% trimmed mean at 50th percentile of the ordered distribution is given at the extreme.

The most reason of using trimmed means is based on the view that distributions of price changes for individual CPI components normally show excess tails or fat tails, which are likely to result into extreme observations from one of the tails of distribution. This means that some observations are not balanced in a particular period since they indicate increase and decrease in prices in one period, and change in another CPI compilation. Therefore, trimmed means are better estimators of the central tendency/part of the distribution than sample means. According to Sharma *et al*. (2015), items in CPI are presented basing on ranks; smallest to largest price change.

Downplaying Volatile items of the Consumer Price Index basket using Persistence.

This approach is set on the ground that rather than excluding items, it is better to downplay the volatile items. Like other rationale for excluding items from core-components, this methodology assumes that volatile items bring noise. The noise items are downplayed with persistence. For example, if prices of items are known to be persistent, then they are likely to convey relevant information about inflationary pressure, as they are more likely to get through the price chain. The importance of persistence has been widely acknowledged by most economists who are interested in core – inflation measure based on persistence. This is because volatility and persistence are two independent dimensions. This means that if a nation or economists focus on one dimension (persistent or volatility) in compiling core – inflation, relevant information is thrown away. This calls for a new account of core-inflation that must take into account both volatility and persistent in order to be all inclusive and get rich information. This information is supported by the Brazilian data revealing that once one approach is used to exclude items from core – inflation components, poor performance is obtained (Voinea Laurentiu, 2013). Using both volatility and persistence have far reaching effects not only to nations or economists measuring core-inflation but also individuals for the future trends.

Nícias and Figueiredo (2014) noted that while it is simple to calculate volatility, economists found it hard to calculate persistence. This is one of the factors behind the failure to use persistence to reach to core-inflation among nations. Various studies have presented different approaches to calculate persistence, but the most commonly used is the sum of auto-regressive coefficients (ARq) in a univariate inflation equation as adopted from Nícias and Figueiredo ().

Methodology

Data sources

The data used in this study was obtained from UBOS in form of secondary information of CPI from July 2010 to June 2017. This represents 84 data points.

CPI compiled by UBOS covers 10 monitored baskets distributed within the country. They include Kampala – (Kampala High Income, Kampala Low and Middle Income), Jinja, Mbale, Masaka, Mbarara, Gulu, Arua and Fort portal (UBOS, 2015).

Measurement of Variables

The measurement variables used in validating the reliability of excluded items from the core basket of goods and services were volatility and persistence.

Volatility

Volatility is the degree of variation or dispersion of prices over time. In this study, variation in consumer price indices was considered. Volatility was measured using standard deviation given by the formula.

$$PV = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2} \quad \text{………………………………………………….. (3.1)}$$

Where x_i is the consumer price index (CPI) for the ith month

$\bar{x}$ is the average consumer price index

PV is the Price Volatility

n is the number of observations

Persistence

Persistence refers to how long prices take before changing. In this study, consumer price indices were used and subjected to persistence tests.

Literature presents several methods for estimating persistence, such as the largest autoregressive root (e.g. Cogley and Sargent, 2001), the number of times the mean of inflation is crossed during a given period (Marques, 2004) and the half-life (Pivetta and Reis, 2007). However, the most common method is the sum of the autoregressive coefficients in a univariate inflation equation. According to Andrews and Chen (1994) this method provides the best scalar measure of persistence.

Various studies as mentioned above have presented different approaches to calculate persistence, but the most commonly used is the sum of auto-regressive coefficients (ARq) in a univariate inflation equation as adopted by Nícias and Figueiredo (2014).Therefore, in this study, the sum of the coefficients of an AR (q) model is used as a measure of persistence. For each item j we run the following recursive regression using monthly, seasonally adjusted, data:

$$\text{ð}_{j,t} = \text{á}_j + \sum_{i=1}^{qj} \text{ñ}_{j,t-i}\text{ð}_{j,t-i} + \text{å}_{j,t} \quad \text{……………………………………………….. (3.2)}$$

Whereby,

$\text{ð}_{j,t}$ is an items j monthly inflation

$\text{ñ}_{j,t}$ is monthly price index for the item j = 1, 2, 3, 4, 5,………………..

The second objective was to re-compile core-index and inflation based on validated items from the objective one. In order to do this, the modified formula of laysperes (Yuan & Li, 2010) was used. Thus;

$$CPI = \frac{\sum_{i=1}^{n} w_{it-1}\frac{p_{it}}{p_{it-1}}}{\sum_{i=1}^{n} w_{it-1}} \quad \text{…………………………………………………………. (3.3)}$$

Where,

w_{it-1} is the weight in the previous period

p_{it} current price

p_{it-1} price in the previous period

$\frac{p_{it}}{p_{it-1}}$ is the price relative

The last objective was to test the significant difference between the existing core-inflation and the recompiled core-inflation. This test was done using the z-test for mean difference between the recompiled and existing core index. A z test is a statistical test used to determine whether two population means are different when the variances and means are known and the sample size is large.

$$z = \frac{\bar{x}_1 - \bar{x}_2 - \Delta}{\sqrt{ó_1{}^2 n_1 + ó_2{}^2 n_2}} \quad \text{..... (3.4)}$$

Where $\bar{x}_1$ and $\bar{x}_2$ are the means of the two samples, **Δ** is the hypothesized difference between the population means, $\boldsymbol{\sigma}_1$ and $\boldsymbol{\sigma}_2$ are the standard deviations of the two populations , and n_1 and n_2 are the sizes of the two samples.

Data Analysis

The data was analyzed using E-VIEWS and EXCEL in order to validate included and excluded items as core components.

In this study, the sum of the coefficients of an AR (q) model was used as a measure of persistence. This was done by EVIEWS at lag 1. Volatility was obtained by using standard deviation using EXCEL. Recompilation of the core index was done using the modified laspeyres. The z test statistic was employed to determine if there exists a significant difference between the recompiled and existing core index.

Hypotheses testing

In determining the reliability of excluded items from core inflation components, the median of both volatility and persistence was used as the rejection criteria.

For volatility, the test hypothesis was

Ho: All items above the median are volatile

Ha: All the items above the median are not volatile

For persistence, the test hypothesis was

Ho: All items above the median are persistent

Ha: All the items above the median are not persistent

After subjecting the food crops and EFU to volatility and persistence tests, the median was used as a threshold to determine which items are less volatile, highly volatile, less persistent and highly persistent.

On the volatility axis, items above the median were observed to be highly volatile and those below the median were observed to be less volatile. Similarly, on the persistence axis, items above the median were observed to be highly persistent and those below were observed to be less persistent. Items that met the assumptions/ criterion of being included in the core inflation basket are those that were observed to be less volatile and at the same time highly persistent.

In testing whether there is a significant difference between the recompiled and existing core index, the z-test for mean difference was used. The means of the recompiled and existing core index was calculated and subjected to the hypothesis below.

$$H_o: \overline{x_1} = \overline{x_2}$$

$$H_a: \overline{x_1} \neq \overline{x_2}$$

Rejecting the null hypothesis ($p<0.05$) means that the two means are not equal and a conclusion can be made that there is a significant difference between the recompiled and existing core index. In this study however, the null was accepted implying that there was no significant difference between the existing and recompiled core index.

Analysis Of Viability Of Core Inflation Components.

Exploring price fluctuations of selected EFU and food items

Prices of agricultural products succumb to seasonal changes and therefore food and related items are excluded from the core basket of goods and services. Figure 4.1 shows a representation of the behavior of selected EFU and food items.

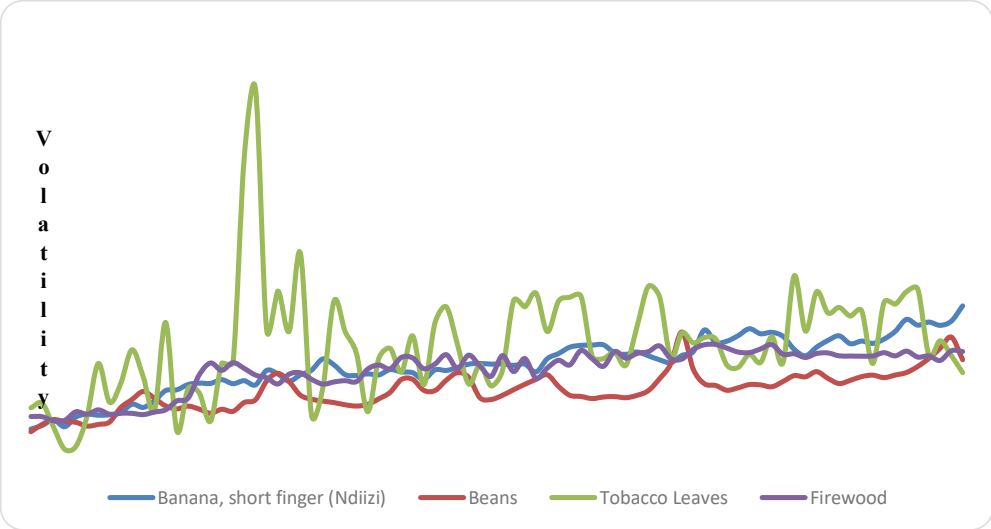


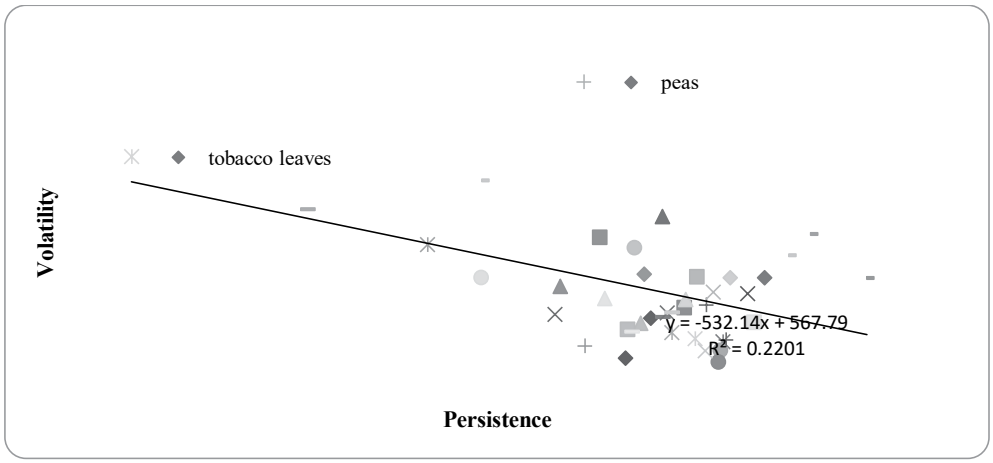
Figure 1: Price volatility of selected EFU and food items.

Figure 1 reveals that some items excluded from the core are relatively stable in prices over time. Items like beans, bananas and firewood were noted to be relatively stable when compared to tobacco leaves during the study period. The trend therefore suggests that among the items classified under EFU and food basket of goods and services, there exists some that meet the criterion/assumption of being less volatile qualifying them for inclusion into the core basket.

Persistence and Volatility

Modified approach requires that an assessment of price volatility be accompanied with persistence in order to determine how long the prices take to fluctuate. Persistence refers to how long prices take before changing. This is measured by using the sum of auto-regressive coefficients (ARq) in a univariate inflation equation. Volatility refers to the degree of variation of prices over time and is measured by the standard deviation. Figure 2 shows a scatter plot of volatility and persistence for food and EFU items.

Figure 2: Persistence and Volatility for all EFU and Food items.



The results show that there exists a negative relationship between price volatility and persistence. This implies that the higher the variation in prices, the lower the persistence and vice versa. These results concur with Babetskii et. al, 2007), who revealed that price dispersion, as a proxy for volatility, is found to be negatively related to inflation persistence, suggesting that the higher the level of volatility, the lower persistent prices become. In light of this explanation, tobacco leaves and peas were noted to be among the items with extremely high price volatility and relatively low persistence.

Table 1 shows individual commodity price volatility and persistence for all food and related items during the study period July 2010-June 2017.

Table 1: Persistence and Volatility for all Food crops and related items.

ITEM	PERSISTENCE	VOLATILITY
Oranges	1.000	28.842
Other Citrus fruits	0.995	48.586
Cooking Bananas (Matoke)	1.001	53.850
Banana, short finger (Ndiizi)	1.009	34.772
Banana, Standard (Bogoya)	1.007	22.977
Apple, Typical Local Variety	1.007	20.776
Avocado	1.005	32.113
Sugarcane	1.015	49.461
Passion fruit	1.001	29.098
Watermelon	0.997	19.060
Papaya	1.003	31.275
Ginger Fresh	0.999	27.588
Pineapple	1.001	30.083
Mango	1.002	25.187
Groundnuts	1.006	17.856
Groundnuts – Roasted	1.007	23.496

Whole grain maize	1.021	38.708
Simsim Grains	1.002	30.183
Sorghum Grains	1.011	38.823
Fresh Leaf Vegetables	0.998	26.024
Green cabbage	0.991	36.694
Tomatoes	0.991	29.682
Egg Plants and Bitter Tomatoes	0.978	46.898
Bell pepper (Green pepper)	0.984	38.689
Green Beans (French beans)	0.993	21.939
Pumpkin	1.013	44.187
Fresh okra	0.967	55.545
Fresh Beans	0.999	39.598
Carrots	1.004	38.882
Round Onions	0.995	33.630
Onions Garlic	1.006	35.224
Beans	1.004	23.698
Cowpeas	0.998	46.008
Peas	0.993	86.955
Malewa	0.984	62.618
Brown Potatoes -Irish potatoes	0.998	25.500
Sweet Potatoes	1.007	38.809
Whole Cassava	1.010	27.768
Cassava Dried	1.003	33.400
Milk - Fresh un-skimmed	1.005	20.804
Tobacco Leaves	0.950	68.478
Mean	**0.999**	**36.189**
Median	**1.001**	**33.400**
Standard Deviation	**0.013**	**14.331**

From Table 1, it was observed that malewa, peas, tobacco leaves have the highest volatility. Low volatility was observed in ground nuts, apples, milk fresh un- skimmed among others. High persistence was observed in maize grains, sugar cane, sorghum grains and pumpkins among others. For purposes of further analysis, persistence and volatility for all EFU was calculated and the results obtained are shown in Table 2.

Table 2: Persistence and Volatility for all EFU items.

ITEM	PERSISTENCE	VOLATILITY
Water charges – NWSC	1.005	18.610
Water Charges - Other Sources	1.008	36.647
Electricity	1.006	23.185
Liquefied gas: propane	1.005	28.419
Kerosene/Paraffin	1.002	13.976
Charcoal	1.005	32.438
Firewood	1.003	27.604
Petrol	1.002	7.658
Diesel	1.002	15.723
Mean	**1.004**	**22.696**
Median	**1.005**	**23.185**
Standard Deviation	**0.002**	**9.448**

It is observed that liquid fuels namely kerosene, petrol and diesel have the least volatility though with low persistence. Volatility and persistence deviations for food and related items and EFU were calculated using the median. This was an important dimension used to validate the excluded items from the core components. The median was set as a threshold (cut off point) for validating the excluded items. The results are shown in Table 3.

Table 3: Persistence and Volatility for all Food and related items, EFU and deviations from the median

ITEM	PERSISTENCE	VOLATILITY	Deviation from median[1]	Deviation from median[2]
Oranges	1.000	28.842	-0.002	-1.888
Other Citrus fruits	0.995	48.586	-0.007	17.857
Cooking Bananas (Matooke)	1.001	53.850	-0.001	23.120
Banana, short finger (Ndiizi)	1.009	34.772	0.007	4.042
Banana, Standard (Bogoya)	1.007	22.977	0.005	-7.752
Apple, Typical Local Variety	1.007	20.776	0.004	-9.953
Avocado	1.005	32.113	0.003	1.383
Sugarcane	1.015	49.461	0.013	18.731
Passion fruit	1.001	29.098	-0.001	-1.631
Watermelon	0.997	19.060	-0.005	-11.670
Papaya	1.003	31.275	0.001	0.546
Ginger Fresh	0.999	27.588	-0.003	-3.141
Pineapple	1.001	30.083	-0.001	-0.646
Mango	1.002	25.187	0.000	-5.543
Groundnuts	1.006	17.856	0.004	-12.873
Groundnuts – Roasted	1.007	23.496	0.005	-7.234
Whole grain maize	1.021	38.708	0.018	7.979
Simsim Grains	1.002	30.183	0.000	-0.546
Sorghum Grains	1.011	38.823	0.009	8.093
Fresh Leaf Vegetables	0.998	26.024	-0.005	-4.705
Green cabbage	0.991	36.694	-0.011	5.965
Tomatoes	0.991	29.682	-0.012	-1.047
Egg Plants and Bitter Tomatoes	0.978	46.898	-0.024	16.168
Bell pepper (Green pepper)	0.984	38.689	-0.019	7.960
Green Beans (french beans)	0.993	21.939	-0.009	-8.790
Pumpkin	1.013	44.187	0.011	13.458
Fresh okra	0.967	55.545	-0.035	24.815
Fresh Beans	0.999	39.598	-0.003	8.868
Carrots	1.004	38.882	0.002	8.152
Round Onions	0.995	33.630	-0.007	2.900
Onions Garlic	1.006	35.224	0.004	4.495
Beans	1.004	23.698	0.002	-7.031
Cowpeas	0.998	46.008	-0.004	15.278
Peas	0.993	86.955	-0.009	56.226
Malewa	0.984	62.618	-0.019	31.889
Brown Potatoes -Irish potatoes	0.998	25.500	-0.004	-5.230
Sweet Potatoes	1.007	38.809	0.005	8.080
Whole Cassava	1.010	27.768	0.008	-2.961
Cassava Dried	1.003	33.400	0.001	2.670
Milk - Fresh un-skimmed	1.005	20.804	0.003	-9.925
Tobacco Leaves	0.950	68.478	-0.052	37.749
Water charges - NWSC	1.005	18.610	0.002	-12.119
Water Charges - Other Sources	1.008	36.647	0.006	5.918
Electricity	1.006	23.185	0.004	-7.544
Liquefied gas: propane	1.005	28.419	0.003	-2.311
Kerosene/Paraffin	1.002	13.976	0.000	-16.754
Charcoal	1.005	32.438	0.002	1.709
Firewood	1.003	27.604	0.001	-3.125
Petrol	1.002	7.658	0.000	-23.072
Diesel	1.002	15.723	0.000	-15.006
Mean	**1.000**	**33.760**	-	-
Standard Error	**0.002**	**2.048**	-	-
Median	**1.002**	**30.729**	-	-
Standard Deviation	**0.012**	**14.480**	-	-

Note: median1 is the median persistence of all the EFU and Food components; median2 is the median volatility of all EFU and Food components.

Validation of core-inflation components was based on results obtained in the table 4.3. It is from this that items below and above the threshold (median) were established. Items above the median along the persistence axis were observed to be highly persistent while those below were observed to be less persistent.

Similarly, items above the median along the volatility axis were observed to be highly volatile while those below were observed to be less volatile. It was further noted that some items were observed to be highly persistent and less volatile qualifying them to be included in the core inflation basket. Results obtained from subjecting persistence and volatility to median tests were then plotted for further analysis as shown in Figure 3.

Figure 3: Persistence and Volatility for All EFU and Food items at median.

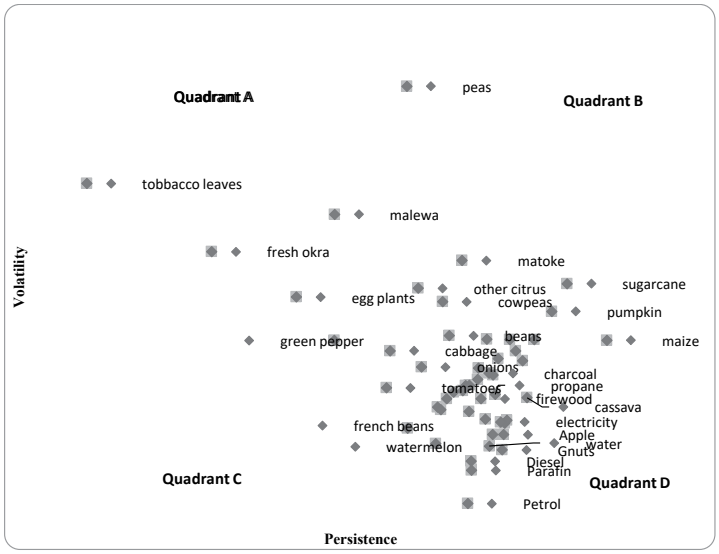


Figure 3 presents four quadrants A, B, C and D each containing items classified according to volatility and persistence. All items in quadrants A and B were noted to have high volatility (above median) while items in quadrants C and D were noted to have low volatility (below median). Similarly quadrants B and D contain items with high persistence (above median) while A and C contain items with low persistence (below median).

The analysis also reveals that food and related items were more volatile than EFU items. This result is supported by the fact that agricultural products succumb to seasonal changes that cause fluctuations in prices from time to time. Particularly agricultural products namely tobacco leaves, peas, matooke and malewa were noted to have recorded the highest volatility while whole cassava, water melon, apple, ground nuts and french beans were noted to have recorded the least price volatility during the study period. On the other hand, among the EFU items namely petrol, diesel, paraffin, NWSC water, firewood and electricity were noted to have recorded the least variation in prices during the study period.

The study indicated that some EFU and food items that are traditionally excluded from the core basket of goods and services were noted to meet the assumptions for inclusion into the core basket. The study noted that items in quadrant D met the assumptions of being less volatile and more persistent. These items include diesel, paraffin, ground nuts, NWSC water, apples, electricity, whole cassava, firewood, banana bogoya, beans dry, milk fresh un skimmed and propane gas.

However, Nícias and Figueiredo (2014) in their study " A Volatility and Persistence- based Core Inflation" did not put emphasis on items that were observed to be more persistent and less volatile rather those that

were more persistent despite being highly or less volatile. They argued that items that are more persistent despite being highly volatile should be included since their exclusion may imply loss of information. These included rice, beans and corn, poultry and eggs, fats and oils, sugar and sweets, bakery products, flour and prepared flour mixes. However, this study concentrated only on items that were strictly less volatile and more persistent.

Hazran, 2017), reveals that inclusion of energy prices would distort a trend increase in general price levels since energy price fluctuations are believed to result from external factors other than the underlying trend increase in general prices. This study agreed with the findings and also noted that stability in the EFU components was partly attributed to pre-determined prices of items such as NWSC water, electricity, paraffin, propane gas and diesel either through statutory authorities or price leading firms.

For comparison purposes, core inflation components were equally subjected to a volatility and persistence test and deviations from the median calculated. The results are shown in table 4 in the annex. Volatility and persistence deviations from the median were then plotted to ascertain the presence of outliers as shown in Figure 4.

Figure 4: Persistence and volatility for all core items at median point.

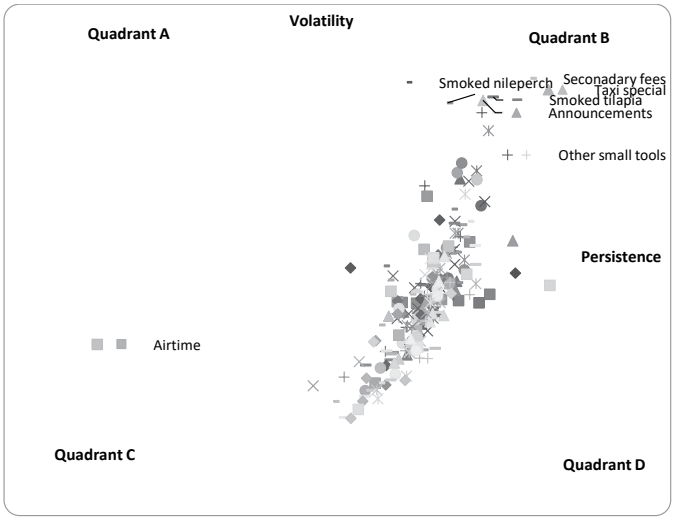


Figure 4 shows both Volatility and persistence for all core items hinged at the same median point as that of figure 3. The above figure shows that not all core inflation items are fit to be included in the core inflation basket based on volatility and persistence. While Quadrant D had the highest concentration of items that were less volatile and fairly persistent, outliers were observed in quadrants B and C. These include Smoked Nile perch, Smoked tilapia, Secondary school fees, Taxi fares for special hire, Media announcement charges, Airtime among others. In Nícias and Figueiredo (2014) perspective, items with a fairly high persistence should be included in the compilation of the core inflation irrespective of whether they have a low or high volatility, an approach that defies the traditional assumption of volatility as a consideration for items to be included as core items. In their study, persistence seemed to play a big role and Quadrant B items would therefore be included in the compilation of core inflation. However, in this study, volatility and persistence are considered to be negatively related and therefore items with a low volatility and fairly high persistence were considered fit to be included in the core basket of items.

The study then went ahead and incorporated these validated items from figure 3 to recompile the core index as shown in the next section. The items considered were only those that had a low volatility and were fairly persistent.

Adjusted core basket of goods and services.

This section integrated the items said to be less volatile and fairly persistent (items in quadrant D) into the existing core basket of goods to get a fairly inclusive adjusted core basket of goods and services. Consequently, new composite monthly price indices were recompiled using modified laspeyres method. The results are shown in appendix A.

The study then went ahead to aggregate the monthly recompiled results into quarterly numbers for both the existing and recompiled core indices and inflation. These results are shown in appendix B.

From appendix B, the quarterly numbers obtained are in close proximity though different. This implies that there is a close relationship between the recompiled and existing core indices and inflation. This prompted the study to employ further diagnostics to confirm if these trends are closely related. Figure 5 shows a graph drawn from appendix B giving more insight on the price movements for the recompiled and the existing core indices and inflation levels.

Figure 5: Quarterly recompiled and existing core index and inflation.

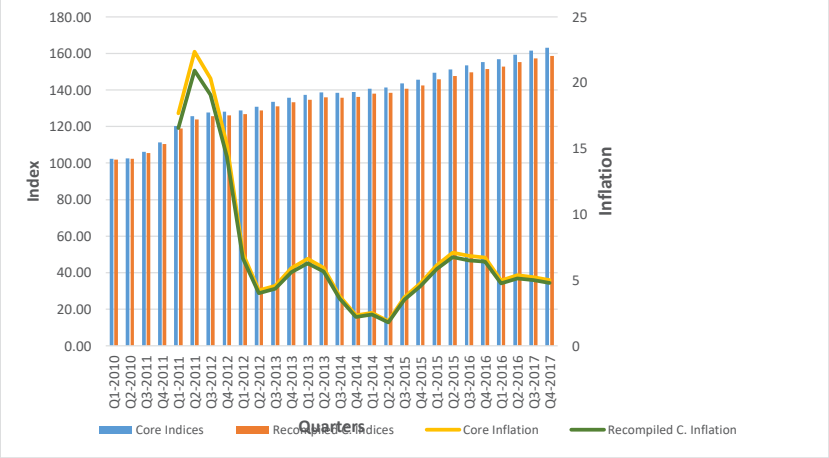


Figure 5, shows quarterly indices and inflation numbers for the recompiled and existing core components from Q1-2010 to Q4-2017. It shows price levels from Q1-2010 and inflation levels from Q1-2011 to Q4-2017. This is so because Q1-2010 to Q4-2011 is the reference period for computation of the quarterly inflation figures. It is evident that the price levels and inflation numbers for the recompiled and existing core trends move in the same direction and magnitude.

The results of the recompiled core index obtained and the existing core index were compared to determine whether there is a significant difference between them. Table 4 shows the z-test results for mean difference between the recompiled and existing core index.

Table 4: Z-test results for comparing recompiled and existing core index means.

	Recompiled core	Existing core
Mean	134.14	136.71
Known Variance	252.09	289.44
Observations	84	84
Hypothesized Mean Difference	0	
Z	-1.012	
P(Z<=z) one-tail	0.156	
z Critical one-tail	1.645	
P(Z<=z) two-tail	0.311	
z Critical two-tail	1.960	

Table 4 shows that there was no significant difference between recompiled and existing core index at 5% level of significance considering that the p value (0.311) is greater than 0.05. However, the recompiled core index was noted to have relatively low variation (δ=15.87) compared to the existing core index (δ=17.00) implying that exclusion of some items leads to loss of information and therefore susceptible to error.

Figure 5 also reveals how the indices and inflation trends for the two series (recompiled and existing core components) are closely related. The two trends tend to move in the same direction with relatively close numbers. This gives more insight on the fact that there was no significant difference between the two trends.

Conclusions and Implication for policy.

The study reveals that while EFU and food items are traditionally excluded from the core, some are viable for inclusion because they are less volatile and fairly persistent. These items include diesel, paraffin, ground nuts, NWSC water, apples, electricity, whole cassava, firewood, banana bogoya, beans dry, milk fresh unskimmed and propane gas. Comparative analysis also shows that not all core inflation items are fit to be included in the core inflation basket based on volatility and persistence.

In light of the findings of the study, the hypotheses that (i) exclusion of items as core-inflation components is not reliable and (ii) there is no significant difference between the existing core- inflation and the recompiled core-inflation. This is attributed to the fact that some of the items excluded from the core basket of goods and services met the assumptions of inclusion after being subjected to volatility and persistence tests, and their inclusion resulted into better estimates.

This study finally suggests a key policy implication of periodically studying inflation by taking consideration of the existing core basket of goods and services based on both volatility and persistence from time to time; as some of the core inflation items in the analysis are observed to be outliers.

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Appendix A

The recompiled and existing core indices and inflation figures.

Month	Recompiled Core Index	Existing Core Index	Existing Core Inflation	Recompiled Core Inflation
Jul-10	101.46	101.69	-	-
Aug-10	101.95	102.22	-	-
Sep-10	102.54	102.85	-	-
Oct-10	102.15	102.44	-	-
Nov-10	101.98	102.25	-	-
Dec-10	102.97	103.31	-	-
Jan-11	104.29	104.72	-	-
Feb-11	105.46	105.98	-	-
Mar-11	106.86	107.48	-	-
Apr-11	108.78	109.54	-	-
May-11	109.98	110.83	-	-
Jun-11	112.33	113.34	-	-
Jul-11	116.29	117.58	15.63	14.62
Aug-11	117.86	119.27	16.68	15.61
Sep-11	122.41	124.14	20.70	19.37
Oct-11	123.26	125.05	22.08	20.66
Nov-11	123.59	125.41	22.65	21.19
Dec-11	124.52	126.40	22.35	20.92
Jan-12	125.19	127.13	21.39	20.05
Feb-12	126.13	128.12	20.89	19.60
Mar-12	125.67	127.63	18.74	17.60
Apr-12	126.02	128.01	16.87	15.85
May-12	126.54	128.56	16.00	15.05
Jun-12	126.08	128.07	12.99	12.24
Jul-12	126.41	128.43	9.23	8.71
Aug-12	126.51	128.53	7.77	7.34
Sep-12	127.28	129.36	4.20	3.98
Oct-12	128.52	130.69	4.51	4.27
Nov-12	128.31	130.47	4.04	3.82
Dec-12	129.42	131.65	4.15	3.94
Jan-13	130.07	132.35	4.11	3.90
Feb-13	131.35	133.72	4.37	4.14
Mar-13	131.89	134.30	5.23	4.95
Apr-13	132.46	134.91	5.39	5.11
May-13	133.24	135.75	5.59	5.30
Jun-13	134.14	136.71	6.75	6.40
Jul-10	101.46	101.69	-	-
Aug-10	101.95	102.22	-	-
Sep-10	102.54	102.85	-	-
Oct-10	102.15	102.44	-	-
Nov-10	101.98	102.25	-	-
Dec-10	102.97	103.31	-	-
Jan-11	104.29	104.72	-	-
Feb-11	105.46	105.98	-	-
Mar-11	106.86	107.48	-	-
Apr-11	108.78	109.54	-	-
May-11	109.98	110.83	-	-
Jun-11	112.33	113.34	-	-
Jul-11	116.29	117.58	15.63	14.62
Aug-11	117.86	119.27	16.68	15.61
Sep-11	122.41	124.14	20.70	19.37
Oct-11	123.26	125.05	22.08	20.66
Nov-11	123.59	125.41	22.65	21.19
Dec-11	124.52	126.40	22.35	20.92
Jan-12	125.19	127.13	21.39	20.05
Feb-12	126.13	128.12	20.89	19.60
Mar-12	125.67	127.63	18.74	17.60
Apr-12	126.02	128.01	16.87	15.85
May-12	126.54	128.56	16.00	15.05
Jun-12	126.08	128.07	12.99	12.24
Jul-12	126.41	128.43	9.23	8.71
Aug-12	126.51	128.53	7.77	7.34
Sep-12	127.28	129.36	4.20	3.98
Oct-12	128.52	130.69	4.51	4.27
Nov-12	128.31	130.47	4.04	3.82
Dec-12	129.42	131.65	4.15	3.94
Jan-13	130.07	132.35	4.11	3.90
Feb-13	131.35	133.72	4.37	4.14
Mar-13	131.89	134.30	5.23	4.95
Apr-13	132.46	134.91	5.39	5.11
May-13	133.24	135.75	5.59	5.30
Jun-13	134.14	136.71	6.75	6.40

Appendix A

The recompiled and existing core indices and inflation figures.

Month	Recompiled Core Index	Existing Core Index	Existing Core Inflation	Recompiled Core Inflation
Jul-13	134.16	136.73	6.46	6.13
Aug-13	134.53	137.13	6.69	6.34
Sep-13	135.41	138.08	6.74	6.39
Oct-13	136.02	138.73	6.15	5.84
Nov-13	135.89	138.58	6.22	5.90
Dec-13	136.11	138.82	5.45	5.17
Jan-14	135.73	138.42	4.58	4.35
Feb-14	135.50	138.17	3.33	3.16
Mar-14	136.23	138.95	3.46	3.29
Apr-14	135.76	138.45	2.62	2.49
May-14	136.43	139.16	2.51	2.39
Jun-14	136.47	139.21	1.82	1.73
Jul-14	137.31	140.11	2.48	2.35
Aug-14	137.94	140.79	2.67	2.54
Sep-14	138.49	141.38	2.39	2.27
Oct-14	138.23	141.10	1.71	1.63
Nov-14	138.38	141.26	1.93	1.84
Dec-14	138.67	141.56	1.97	1.88
Jan-15	140.22	143.22	3.47	3.31
Feb-15	140.16	143.17	3.62	3.44
Mar-15	141.40	144.49	3.98	3.79
Apr-15	142.04	145.18	4.86	4.63
May-15	142.20	145.34	4.44	4.23
Jun-15	142.93	146.13	4.97	4.73
Jul-15	144.55	147.87	5.53	5.27
Aug-15	146.02	149.44	6.15	5.86
Sep-15	147.33	150.84	6.69	6.38
Oct-15	147.24	150.75	6.84	6.52
Nov-15	147.61	151.14	7.00	6.67
Dec-15	148.40	151.99	7.37	7.02
Jan-16	149.11	152.76	6.66	6.34
Feb-16	149.29	152.95	6.83	6.51
Mar-16	150.82	154.58	6.99	6.66
Apr-16	150.77	154.53	6.44	6.15
May-16	151.43	155.24	6.81	6.49
Jun-16	152.25	156.12	6.84	6.53
Jul-16	152.43	156.31	5.71	5.45
Aug-16	153.02	156.94	5.02	4.79
Sep-16	153.17	157.10	4.15	3.97
Oct-16	154.42	158.44	5.11	4.88
Nov-16	154.85	158.90	5.13	4.90

Appendix B

Quarterly numbers for recompiled and existing Core indices and Inflation.

Quarters	Existing Core Indices	Recompiled Core Indices	Existing Core Inflation	Recompiled Core Inflation
Q1-2010	102.25	101.98	-	-
Q2-2010	102.67	102.37	-	-
Q3-2011	106.06	105.54	-	-
Q4-2011	111.24	110.37	-	-
Q1-2011	120.33	118.85	17.7	16.5
Q2-2011	125.62	123.79	22.4	20.9
Q3-2012	127.63	125.66	20.3	19.1
Q4-2012	128.22	126.21	15.3	14.4
Q1-2012	128.77	126.73	7.0	6.6
Q2-2012	130.94	128.75	4.2	4.0
Q3-2013	133.46	131.10	4.6	4.3
Q4-2013	135.79	133.28	5.9	5.6
Q1-2013	137.31	134.70	6.6	6.3
Q2-2013	138.71	136.01	5.9	5.6
Q3-2014	138.51	135.82	3.8	3.6
Q4-2014	138.94	136.22	2.3	2.2
Q1-2014	140.76	137.92	2.5	2.4
Q2-2014	141.30	138.43	1.9	1.8
Q3-2015	143.63	140.59	3.7	3.5
Q4-2015	145.55	142.39	4.8	4.5
Q1-2015	149.38	145.97	6.1	5.8
Q2-2015	151.30	147.75	7.1	6.7
Q3-2016	153.43	149.74	6.8	6.5
Q4-2016	155.30	151.48	6.7	6.4
Q1-2016	156.79	152.87	5.0	4.7
Q2-2016	159.41	155.32	5.4	5.1
Q3-2017	161.45	157.23	5.2	5.0
Q4-2017	163.07	158.74	5.0	4.8

Appendix C

Persistence and Volatility for all Core Components and deviations from the median.

ITEM	PERSISTENCE	VOLATILITY	Deviation from median[1]	Deviation from median[2]
Rice- Pakistan, Basmati, Long grain & Family Pack	1.004	13.014	0.002	-17.715
Other Rice	1.008	19.264	0.006	-11.465
Bread - Loaf	1.004	14.787	0.002	-15.943
Bread -Buns	1.005	20.403	0.003	-10.327
Macaroni	1.005	15.651	0.003	-15.079
Spaghetti	1.004	15.668	0.002	-15.061
Biscuits	1.005	17.903	0.003	-12.826
Cakes	1.002	5.502	-0.001	-25.228
Doughnuts	1.005	17.197	0.003	-13.533
Maize Flour	1.010	22.552	0.008	-8.177
Millet Flour	1.008	17.928	0.005	-12.801
Cassava Flour	1.010	27.456	0.007	-3.273
Cornflakes (e.g. Kellog's)	1.006	23.828	0.004	-6.901
Meat -Beef	1.006	28.596	0.004	-2.133
Offals - Beef	1.008	32.714	0.006	1.985
Beef liver	1.006	26.497	0.004	-4.233
Pork	1.006	25.733	0.004	-4.996
Goats meat/Mutton	1.007	29.876	0.004	-0.854
Traditionally bred live chicken	1.005	20.470	0.003	-10.259
Live chicken Off layer	1.004	17.901	0.002	-12.828
Turkey	1.006	36.924	0.004	6.195
Sausages	1.008	33.373	0.006	2.644
Tilapia Fresh	1.007	38.079	0.005	7.350
Nile Perch Fresh	1.006	37.749	0.004	7.020
Dried kapenta (Mukene)	1.004	35.841	0.002	5.112
Smoked Nile Perch	1.006	48.448	0.004	17.719
Smoked Tilapia	1.008	49.347	0.006	18.617
Dried fish-Angara	1.000	23.351	-0.002	-7.378
Milk - Fresh un-skimmed-Packed	1.006	18.286	0.004	-12.444
Milk, powdered	1.006	25.827	0.004	-4.902
Yoghurt	1.006	26.123	0.004	-4.607
Ghee un processed	1.007	24.500	0.005	-6.229
Eggs	1.006	21.666	0.004	-9.064
Margarine	1.006	19.146	0.004	-11.583
Olive oil	1.002	23.590	0.000	-7.139
Refined Oil	1.004	10.829	0.002	-19.900
Other Edible Animal Fats	1.004	16.594	0.002	-14.136
Sugar	1.005	34.195	0.002	3.465
Natural honey	1.006	21.282	0.004	-9.447
Chocolates	1.003	15.564	0.001	-15.166
Sweets (Hard candies)	1.004	15.271	0.002	-15.458
Ice Cream	1.005	16.335	0.003	-14.394
Tomato ketchup	1.005	19.148	0.003	-11.581
Cooking salt	1.006	25.699	0.004	-5.030
Curry Powder	1.004	20.745	0.002	-9.985
Chili sauce	1.005	30.628	0.003	-0.101
Chili powder	1.003	17.995	0.001	-12.735
Cinnamon powder	1.004	17.344	0.002	-13.386
Ginger Powder	1.006	30.376	0.004	-0.353
Baby foods	1.005	15.473	0.002	-15.256
Coffee	1.005	18.145	0.002	-12.585
Tea leaves	1.005	17.425	0.003	-13.305
Mineral water	1.006	32.265	0.004	1.536
Sodas in markets and shops	1.004	16.506	0.002	-14.223
Fruit juices	1.005	16.329	0.003	-14.400
Local Gin (Waragi purified)	1.005	15.379	0.002	-15.350
Smirnoff Vodka	1.003	10.079	0.001	-20.650
Red /White wine	1.005	13.709	0.002	-17.020
Domestic Beer - Bottled	1.004	17.590	0.002	-13.139
Cigarette - Sportsman	1.005	18.488	0.003	-12.242
Cigarette - Dun Hill	1.004	20.961	0.002	-9.768
Clothing Materials	1.006	24.444	0.004	-6.286
Men's Garments	1.006	30.092	0.004	-0.637
Second Hand Shirts	1.004	18.624	0.002	-12.106
Garments for women	1.007	27.226	0.005	-3.503
Second Hand Dresses	1.008	48.836	0.006	18.107
Garments for children (3 to 13 years) and infants (0 to 2 years)	1.007	36.511	0.005	5.782
Second Hand Baby Rummage	1.006	28.590	0.004	-2.140
Cleaning of Clothing	1.004	12.163	0.002	-18.567
Repair and Tailoring of Clothing	1.003	14.267	0.001	-16.462
Shoes for School going students	1.006	21.038	0.004	-9.691
Other men's shoes	1.005	18.279	0.003	-12.451

Women's shoes	1.004	15.477	0.002	-15.252
School going Children's Shoes	1.006	20.870	0.004	-9.860
Other Children Shoes	1.004	11.733	0.002	-18.996
Single room not self-contained	1.004	17.097	0.002	-13.632
Single room Self contained	1.008	44.189	0.006	13.460
Double room not self-contained	1.005	21.617	0.003	-9.113
Double room Self contained	1.006	28.067	0.004	-2.663
Triple or more rooms self-contained	1.005	24.576	0.003	-6.154
Cement (Portland)	1.002	9.312	0.000	-21.418
Corrugated Iron Sheets	1.002	8.443	0.000	-22.286
Paint	1.005	18.486	0.003	-12.243
Nails	1.003	9.467	0.001	-21.262
Other Services relating to the dwelling n.e.c	1.003	22.081	0.000	-8.648
Beds	1.006	25.554	0.004	-5.176
Side Boards	1.007	39.240	0.004	8.511
Dining tables	1.008	46.955	0.006	16.226
Sofa sets	1.006	25.524	0.004	-5.205
Coffee Sets	1.007	23.858	0.005	-6.872
Carpets and other floor coverings	1.005	25.284	0.003	-5.446
Mattresses	1.004	13.685	0.002	-17.044
Blankets	1.006	19.856	0.004	-10.874
Flat sheets	1.004	20.299	0.002	-10.431
Mosquito Nets	1.003	14.474	0.001	-16.255
Towels	1.004	15.361	0.002	-15.368
Refrigerators	1.002	10.607	0.000	-20.122
Charcoal Stoves	1.007	28.020	0.005	-2.709
Electric Cookers	1.001	8.505	-0.001	-22.225
Electric Irons	1.004	16.154	0.002	-14.576
Electric Kettles	1.003	18.143	0.001	-12.586
Glass and crystal-ware, tableware	1.006	16.071	0.003	-14.659
Other Cutlery, flatware and silverware	1.005	16.593	0.003	-14.137
Batteries (Dry Cells)	1.007	20.904	0.005	-9.826
Hand Lamps	1.007	22.947	0.005	-7.782
Other Small tools and miscellaneous accessories	1.009	40.502	0.007	9.772
Laundry Soap Bar	1.005	15.480	0.002	-15.249
Detergent powder	1.005	16.522	0.003	-14.208
Shoe Polish	1.005	21.616	0.003	-9.113
Match Box	1.004	26.082	0.002	-4.647
Household candles	1.003	16.582	0.001	-14.147
Brooms	1.004	16.307	0.001	-14.422
Brush	1.005	22.415	0.003	-8.314
Anti-Malaria drugs	1.003	11.812	0.001	-18.917
Cold Tablets/Cough syrup	1.004	11.688	0.001	-19.042
Fever/Pain Killers	1.004	19.283	0.002	-11.447
Balms (Healing Ointments e.g Robb)	1.003	10.418	0.001	-20.312
Dewormers	1.003	18.302	0.001	-12.427
Eear nose and throat (ENT) medicines	1.002	5.742	-0.001	-24.987
Medicine for Blood pressure	1.005	16.375	0.003	-14.355
Medicines for cholesterol and cardiovascular	1.004	14.331	0.002	-16.399
Herbal medicines	1.005	24.466	0.003	-6.264
Men's Condoms	1.006	26.331	0.004	-4.398
High blood pressure apparatus	1.004	19.036	0.002	-11.693
Glucometer/ Sugar monitoring apparatus	1.002	21.483	0.000	-9.246
Consultation Services	1.005	23.267	0.003	-7.462
Antenatal care Services	1.005	21.970	0.003	-8.760
Dental services	1.006	26.608	0.004	-4.121
Blood test	1.005	18.306	0.002	-12.423
Hospitalization Services	1.005	20.792	0.003	-9.938
Child Deliveries Services	1.005	23.189	0.003	-7.540
Second Hand Vehicles	1.003	17.069	0.001	-13.660
Bicycle- Adults	1.006	21.895	0.004	-8.835
Bicycles-Children	1.001	4.738	-0.001	-25.991
Bicycles Spare parts	1.004	15.214	0.002	-15.515
Car battery	1.002	5.485	0.000	-25.244
Other Spare parts and accessories	1.003	13.015	0.001	-17.715
Engine, Gear and Diff oil	1.005	15.133	0.003	-15.596
Servicing of motor vehicle (Labour)	0.998	5.315	-0.004	-25.414
Car wash	1.002	4.730	0.000	-25.999
Puncture repair	1.001	4.527	-0.001	-26.202
Other services in respect of personal transport equipment	1.000	6.719	-0.002	-24.011

Bus Fare Long distance (over 100 KM)	1.002	14.612	0.000	-16.117
Taxi Fares - Shared - Long distance (over 100 KM)	1.002	10.667	0.000	-20.062
Taxi Fares - Shared - Medium Distance (51-100 KM)	1.002	12.240	-0.001	-18.489
Taxi Fares - Shared - Short distance (less than 50 KM)	1.002	19.714	0.000	-11.016
Taxi Fares - Special Hire	1.012	50.476	0.009	19.747
Motorcycle fares	1.004	10.870	0.002	-19.860
Bicycle fares	1.005	18.018	0.003	-12.712
Domestic Flights	1.005	20.014	0.003	-10.716
International Flights	1.003	15.764	0.001	-14.965
Postal services	1.001	4.654	-0.001	-26.075
Cellular Handset- Basic	1.003	10.215	0.000	-20.515
Cellular Handset- Smartphone	1.003	16.310	0.001	-14.420
Cell phone airtime	0.986	11.643	-0.017	-19.086
Internet Services - Cyber Cafe	1.006	25.066	0.003	-5.664
Radio - Portable	1.005	16.459	0.002	-14.270
Radio - Car	1.003	6.814	0.001	-23.916
Television sets	1.002	7.977	0.000	-22.753
Calculators (Basic, scientific, financial, graphing etc	1.003	10.693	0.001	-20.036
Laptop Personal Computer	0.999	2.988	-0.003	-27.742
Video-Movie	1.001	3.764	-0.001	-26.965
Repair and Maintenance of Laptops	1.001	2.998	-0.001	-27.731
Football games (Soccer)	1.012	20.633	0.010	-10.097
Services provided by cinemas, theatres, opera houses etc.	1.002	15.977	0.000	-14.752
Television and radio taxes and hire of equipment	1.001	9.043	-0.001	-21.687
Film processing and photo printing	1.004	10.444	0.001	-20.285
Services of photographers	1.003	7.050	0.001	-23.680
Text Books - Primary Education	1.004	9.579	0.002	-21.151
Text Books - Secondary Education	1.004	11.085	0.002	-19.645
Dictionary	1.005	11.071	0.003	-19.658
Bible	1.001	6.516	-0.001	-24.213
Newspapers	1.005	24.301	0.003	-6.428
Paper blocks	1.004	13.002	0.002	-17.727
Other Stationary and Drawing Materials	1.004	12.154	0.002	-18.575
Pilgrimage - Mecca and Medina (Hijja)	1.002	3.351	0.000	-27.378
Pre-Primary	1.007	36.669	0.005	5.940
Primary	1.007	19.229	0.005	-11.500
Secondary	1.011	52.167	0.009	21.438
Private University -Tuition	1.000	0.506	-0.002	-30.224
Public university -Tuition	1.000	0.443	-0.002	-30.286
Computer Courses	1.001	1.727	-0.002	-29.002
Chapati/Sumbusa/pancakes	1.004	11.946	0.002	-18.783
Sodas in restaurants and bars	1.006	20.668	0.003	-10.061
Fruit Juices	1.005	18.766	0.003	-11.964
Other Meals in Restaurants	1.005	18.991	0.003	-11.738
Red /White wine	1.005	9.521	0.002	-21.208
Beer, Heineken	1.004	13.611	0.002	-17.118
Vodka	1.002	6.259	0.000	-24.470
Whisky (John Walker)	1.003	6.171	0.001	-24.558
Local Brew (e.g Malwa -Millet)	1.007	22.313	0.005	-8.417
Local Gin (Waragi Crude)	1.005	21.274	0.003	-9.455
Pre-primary and Primary school Accommodation Services	1.004	11.285	0.002	-19.445
Secondary school Accommodation Services	1.005	18.009	0.003	-12.720
Tertiary Institutions Accommodation Services	1.004	12.675	0.002	-18.054
Hotel and lodging Accommodation Services	1.006	21.126	0.004	-9.603
Lady Hairdressing	1.004	19.910	0.002	-10.819
Men's Hair Cut	1.007	26.736	0.005	-3.993
Bathing Soap	1.006	19.395	0.004	-11.335
Toothpaste	1.004	11.244	0.002	-19.485
Sanitary Towels	1.003	8.871	0.001	-21.859
Toilet Paper	1.004	10.468	0.001	-20.262
Baby powder	1.007	34.549	0.005	3.820
Tooth brush	1.004	10.644	0.002	-20.086
Perfume	1.005	19.284	0.002	-11.446
Hair food	1.007	30.408	0.005	-0.321
Petroleum Jelly	1.004	19.657	0.002	-11.072

Hand & Body lotion	1.001	12.091	-0.001	-18.638
Baby oil	1.005	24.779	0.003	-5.951
Disposable Babies' Napkins	1.004	12.514	0.002	-18.215
Travel bags	1.004	22.255	0.002	-8.475
Umbrellas	1.005	24.702	0.003	-6.027
Insurance connected with transport	1.004	28.183	0.002	-2.546
Photocopying	1.005	15.261	0.002	-15.468
Passport fees	1.002	5.796	0.000	-24.933
Announcements on T.Vs, Radios and Newspapers	1.009	46.976	0.007	16.246
Sum	**216.966**	**4135.043**		
Mean	**1.004**	**19.144**		
Median	**1.005**	**18.144**		
Standard Deviation	**0.002**	**9.845**		

Note: median[1] and median[2] are the same for all core, EFU and Food components representing persistence and volatility respectively.