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Alternative Core Inflation Measures in Nigeria: An Examination

Ladi R. Bala-Keffi[1], Donald G. Mbaka[2] & Nuruddeen Usman[3]

[1] Deputy Director & Head Macroeconomic Policy and Analysis Division (MPAD), Monetary Policy Department, Central Bank of Nigeria, Nigeria

[2] Economist, Monetary Policy Department, Central Bank of Nigeria, Nigeria

[3] Assistant Economist, Monetary Policy Department, Central Bank of Nigeria, Nigeria

Correspondence: Nuruddeen Usman, Monetary Policy Department, Central Bank of Nigeria, Nigeria. E-mail: nusman2@cbn.gov.ng

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Abstract

Core inflation measures have played an important role in the conduct of monetary policy at various central banks around the world. We examine core inflation in Nigeria using non-traditional measures and assess their persistence, to determine whether the Central Bank of Nigeria (CBN) should pay attention to one or other of these measures when assessing inflation developments. We find that the two new measures outperform the official core rate in tracking the persistence of headline inflation. The findings of this study will aid policy making within the Central bank of Nigeria (CBN) particularly where inflation targeting is adopted as the monetary policy framework. These core inflation measures provide a useful guide to central bankers both for monetary policy decisions and as a communication tool. They are a better predictor of future inflation depicting the more persistent influences on underlying inflation, which are of interest to policymakers (e.g. Clark, 2001; Blinder and Reis, 2005; Smith, 2004 and Dolmas &Wynne, 2008).

JEL Code: C32, E31, E52

Keywords: core inflation, inflation persistence, monetary policy

1. Introduction

The major objective of central banks is to preserve the value of money by maintaining a low rate of inflation, using monetary policy. Inflation is the central theme in monetary policymaking and policymakers need to determine, as a matter of necessity, an appropriate inflation rate conducive to economic growth and other macroeconomic objectives of government. Policymakers are often confronted with price changes that are both permanent and temporary.

Various measurements have been adopted to obtain figures that reflect the change in prices of the representative consumer basket, across the World. Of these, the headline inflation rate (calculated from the change in the consumer price index) is widely published and broadly agreed as an appropriate target variable for monetary policy. In Nigeria, like most other monetary jurisdictions, the National Bureau of Statistics (NBS) provides a monthly estimate for this variable. Scholars have posited that including volatile price components to the representative consumer basket, may be problematic Nessén & Söderström, (2001).

It is established in literature see Quah & Vahey(1995)) that substantial changes in commodity or food prices may lead to volatility in headline inflation rates. This random movement, for such an important variable, may pose challenges to policymakers with respect to obtaining accurate assessments of emerging developments in the inflation rate. More so, a high degree of volatility in the headline rate makes it challenging to differentiate between increases in generalized price and temporary shocks. Bernanke et al. (1999), Bryan and Cecchetti (1994), Mishkin (2007) propose that core inflation measures may be more useful for proper monetary policy management, because they omit highly volatile food and energy prices which are beyond the control of monetary authorities. The motivation behind this proposition also relies on the ability of core inflation measures to better predict future headline inflation.

Core inflation rates have, thus, been advanced as a useful target to mitigate this policy challenge by obscuring the

impact of volatile price changes while focusing on the underlying and more persistent components. In addition, Central Banks that explicitly target inflation rate have also naturally regarded core inflation as a superior gauge of the medium-term inflation trend and a sounder forecaster of future inflation.

The importance of core inflation for implementing an inflation targeting monetary policy framework has been documented in recent years (see Bryan and Cecchetti,1993; Rangasamy, 2009; and Du Plessis et al., 2015). They find that core inflation has a direct effect on the policy-decision making process for inflation targeting countries.

The foremost method for measuring core inflation was introduced in the late 1990s by Bryan, Cecchetti, and Wiggins (1997), built around robust estimators of the central tendency. This trimmed-mean (median) measure does not exclude a particular class of item, but a fixed amount of variance from the upper and lower tails of the monthly price index distribution.

Brischetto and Richards (2006) studied the performance of trimmed-mean core inflation and exclusion-based measures in Australia, the United States, Japan, and the euro area. They use a range of criteria such as ability to track movements in trend headline inflation and predictive power for near-term headline inflation. The authors find that the trimmed-mean measure outperforms the exclusion measure.

Meyer and Venkatu (2014) evaluate the performance of symmetric and asymmetric trimmed means, focusing on forecasting. They find that the median and trimmed CPI inflation rates provide better out-of-sample forecasts of headline CPI inflation compared to headline CPI or CPI excluding food and energy. Different approaches to computing core inflation measures have also been examined extensively by Roger (1998) and Wynne (1999). Roger identifies two (2) concepts of core inflation; one views core inflation as the persistent/volatile component of inflation and the other as a generalized component of inflation.

In recent times, Ball and Mazumder (2019) compared inflation excluding food and energy inflation with weighted-median inflation; they find the weighted-median inflation to be less volatile and more powerfully linked with unemployment when using Phillips curve regressions.

Notable examples of central banks that have adopted this measure in their official Inflation reports and monetary policy statements are the Bank of Canada, Federal Reserve Bank of Cleveland (USA), Reserve Bank of Australia (RBA) and Reserve Bank of New Zealand (RBNZ).

This study seeks to investigate the veracity of this hypothesis when applied to Nigerian data by empirically measuring whether long run inflationary expectations in Nigeria can be deduced from developments in core inflation. Further, we conduct some empirical exercise by using disaggregated data on sectoral inflation to construct indexes akin to core inflation, with time-varying weights.

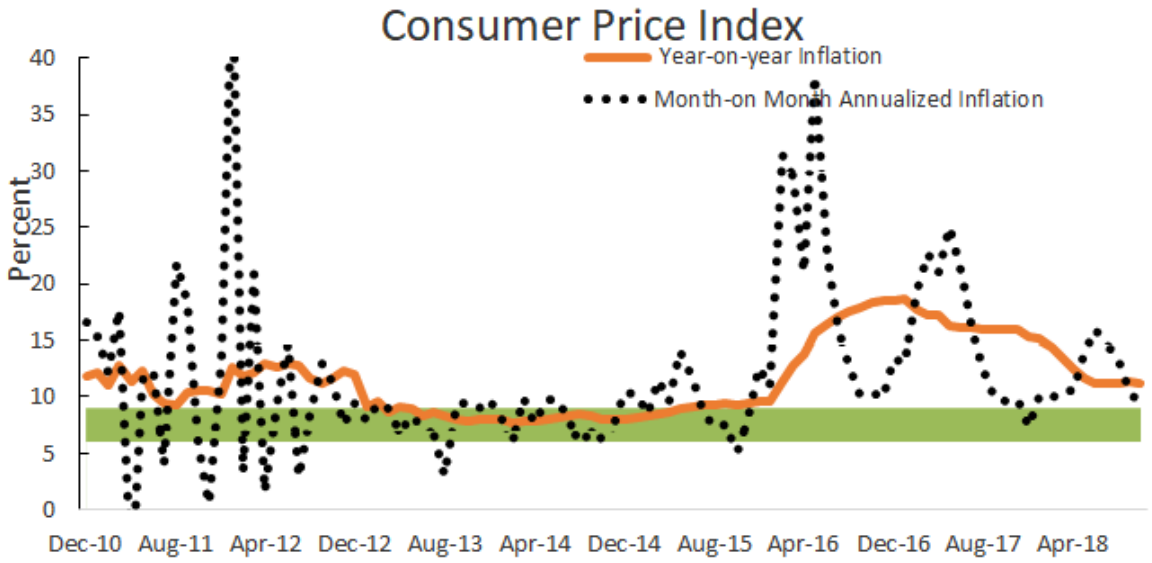

Figure 1. Nigeria's Inflation December 2010- October 2018

The central Bank, after the global financial crisis, initiated a policy of monetary accommodation to tackle the issue of liquidity shortages in the banking sector. However, as seen in figure 1, these events combined with large fiscal expansions had adverse effects on the exchange rate, inflation, and Foreign reserves. This made inflation to exceed its

target range (6 - 9 per cent). Nevertheless, with the introduction of tightening measure, inflation began to subside.

After the introduction, the paper is organized as follows: Section 2 presents the link between core inflation measures and monetary policy; Section 3 confers the methodology; Section 4 presents the results while Section five concludes the study.

2. Monetary Policy and Core Inflation Measures

Core inflation features prominently in the conduct of monetary policy, but its measurement could present significant challenges. There are quite a few methods for computing core inflation, with diverse criteria that may be useful for evaluating these measures. In addition, the various methods of computing core inflation may provide a mixed variety of usefulness for various policy purposes Wiesiołek & Kosior, (2009). Further, the evolution of inflationary developments may vary the usefulness of core measures over a period. The level of confidence that central bankers have in such core inflation measures, therefore, becomes a major consideration.

Core inflation as a measure for policy purposes

An important assertion is the need for policymakers to clearly delineate between permanent and transitory price movements – a key determinant of the appropriateness of monetary policy prescriptions. It is usually considered that monetary policy reactions to temporary price shocks may result to undesirable fluctuations in output. On the other hand, the inability to quickly identify underlying inflation trends may precipitate a persistent rise in inflation that would necessitate policy tightening for a more elongated period Rich & Steindel (2007). Therefore, the extent to which core inflation measures provide information on the nature of price changes may determine their usefulness in guiding monetary policy decisions.

Core inflation is seen as reflecting the part of price changes that is common to all items. This definition is based on the division of inflation to core and non-core components to represent generalized inflation and relative prices of goods and services, respectively. The generalised measure is often related to monetary expansion based on the principle that inflation is always a monetary phenomenon, in the long run Bryan and Cecchetti, (1994). To further underscore this concept, it is also assumed that there is no long-run effect on the aggregate price level as a result of relative price movements. Hence, they do not require a monetary policy response.

There may be broad consensus that core inflation reflects the part of general price movements that is relevant to monetary authorities, but there does not seem to be an agreement on what is “relevant”. Therefore, no single concept of core inflation exists in spite of the pervasive use of the measure in the conduct and formulation of monetary policy. These measures are known to present useful analytical tools and, by extension, viable targets for monetary policy. The question of ‘relevance’ may lead to the development and application of alternative measures of core inflation. Roger (1998) posited that the measurement of core inflation focuses more on the method(s) used to determine a practicable measurement rather than an attempt to describe the phenomenon being measured. Thus, any effort in that direction is usually an attempt to quantify core inflation as either persistent or generalized inflation.

Measures of core inflation

The National Bureau of Statistics (NBS) computes the core inflation rate in Nigeria from changes in the consumer price index (CPI), excluding volatile food and energy prices. However, three broader classes of core inflation measures and the rationale underlying their use have been identified in literature. These include measures that (i) permanently exclude pre-identified components of the CPI (as done by NBS) (ii) based on an explicit statistical criteria exclude certain components on a period-by-period basis and (iii) modulate the role of the most volatile components.

i. Permanently excluding particular components

A typical core inflation measure excludes energy and food from the overall CPI and receives the most public attention. The argument for the exclusion of such volatile components in the calculation of headline inflation rates has been that they are more likely influenced by supply disruptions, and do not necessarily reflect aggregate demand. This scenario produces a one-time change in prices (either positive or negative) that fades over time, provided that the stance of monetary policy does not change.

The most extreme case is to remove the food and energy components. In Nigeria the food component is removed. This type of measure of exclusion from the CPI Basket has a weak economic grounding as noise excluded from the CPI basket or leftover items do not have any shocks. However, it generates the risk of information loss. As in the case of Nigeria, the food component is almost 51 per cent of the CPI Basket.

There are, however, other variants that are readily available or in use. In certain instances, a measure is constructed based on a different and preferred price index of the monetary authority. A central feature of these measures is that the exclusions are permanent.

ii. Trimmed Mean

Using the 'trimmed mean' method, core inflation may be generated by ranking recorded price changes of all the individual CPI components in a given period, in descending or ascending order and excluding a specified top and bottom percentage i.e. the constituents equivalent to a specific percentage of total CPI weights on each side. Inflation is, subsequently, computed as the average of the residual price changes (the median inflation rate) which is equal to a trimm of 50 per cent. Trimmed mean estimates are timely, transparent on their replication and easy to compute once a decision has been made on the nature and size of the trim.

Downplaying the influence of volatile items

A third method handling with volatile components is by substituting the expenditure-based CPI weights with the inverse proportional weight over a given time period. The core inflation rate is calculated using the mean from the volatility-weighted distribution. This method diminishes the influence of volatile items on the average headline inflation rate.This inflation measure is derived from the inflation rate of the CPI excluding 20 of the most volatile components, based on a monthly index (See Appendix A1).

3. Methodology

3.1 Univariate Model for Persistence

Inflation persistence signifies in response to shocks the predisposition of inflation to converge towards its long-run value. In determining persistence of a series, the conventional method in empirical research relies on estimating a univariate Autoregressive (AR) time series model and computing persistence as the sum of the estimated AR coefficients. (Nelson and Plosser, 1982; Fuhrer and Moore, 1995; Pivetta and Reis, 2004). The traditional univariate model to evaluate persistence for a stationary Autoregressive process is given below:

$$\pi_t = \alpha + \gamma Trend + \sum_{i=1}^{p} \beta_i \pi_{t-i} + \varepsilon_t \tag{1}$$

where π_t represents inflation rate, $\sum_{i=1}^{p} \beta_i$ is the summation of the autoregressive method, $\varepsilon_t \sim N\left(0, \sigma_\varepsilon^2\right)$ i.e. ε_t is I(0) and L is the lag operator $\left(Lz_t = z_{t-1}\right)$. Grounded on equation 1, two potential cases to $\sum_{i=1}^{p} \beta_i$ exist. Should $\sum_{i=1}^{p} \beta_i = 0$, then π_t it has low persistence, this implies weak associations of π_t overtime. Further, it can be construed π_t is I(0), i.e. π_t is stationary at level. This implies that impact of policy used by the central bank will have limited influence on the behavior of core inflation rates. On the other hand, should $\sum_{i=1}^{p} \beta_i > 0$, then π_t has high persistence amongst observations. In this situation, central bank polices will affect the Core inflation rate. Even so, the Policy impact of these measures can either be temporary or permanent. if π_t $0 < \sum_{i=1}^{p} \beta_i < 1$ the effect is temporary and mean reverting, where the effect of shocks will dissipate over long horizons, however if $\sum_{i=1}^{p} \beta_i \geq 1$, the

policy impact is permanent, indicating shocks to the inflation rate will persist forever[1].

4. Discussion of Results

4.1 Preliminary Analyses

Monthly data over the period of July 2011 to December 2018 are used in the analysis. The data were obtained from National Bureau of Statistics (2019). Table 1 contains the descriptive statistics for the four inflation components. As depicted in Table 1, the Headline inflation rate recorded higher mean and standard deviation values during the sample period. From the computation of the three (3) core inflation rates, the trimmed mean shows the highest correlation with headline inflation rates, followed by the headline rate excluding 20 of the most volatile items. The two new core inflation measures (trimmed Mean and Headline ex 20 most volatile items) are smoother than the official core inflation rate, as already apparent from Figure 2. also, the Trimmed mean and the headline rate ex 20 most volatile items has a lower standard deviation than the official core inflation measure (Headline excluding food).

We complement the results of the descriptive analyses by plotting the four inflation variables, from figure (1) it can be observed that the non-traditional core measures track inflation better than the official core inflation rate. These observable peculiarities in the behavior of core inflation rates in Nigeria creates a major motivation for doing same in the empirical analyses.

Table 1. Descriptive Statistics

	Headline	**Headline excluding Food (Official Core)**	**Trimmed Mean**	**Headline excluding 20 most volatile Items(89%)**
Mean	11.608	10.917	10.841	11.451
Median	11.141	11.041	9.804	10.957
Std. Dev.	3.378	3.440	3.047	3.185
Skewness	0.669	0.391	0.504	0.462
Kurtosis	2.146	2.217	1.768	1.730
Correlation with Headline Inflation	1	0.885	0.968	0.950
Observations	89	89	89	89

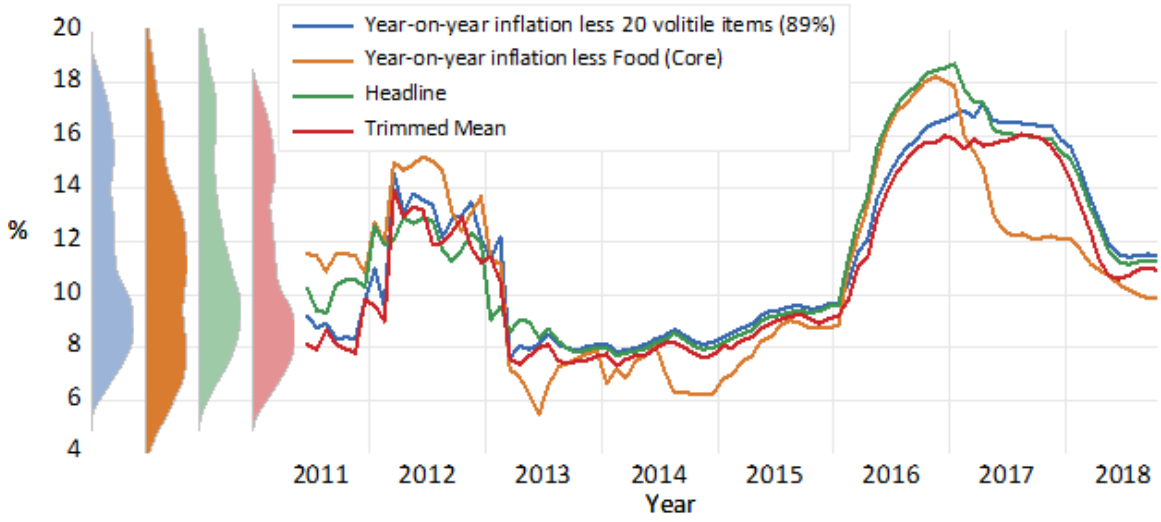

Figure 2. Trends in inflation in Nigeria

[1] The Newey-West (1987) estimator is used in adjusting the standard errors for autocorrelation and heteroscedasticity inherent in the residuals

4.2 Main Results

4.2.1 The Traditional Univariate Model Approach

We evaluate the persistence for each of the inflation rates using the traditional univariate model. The optimal lag length is determined using the Akaike Information Criterion (AIC) From Table 3, regardless of the deterministic element contained in the model, the degrees of the amounts of persistence are close to unity for all series . Leveraging on the Wald test, We test if these magnitudes were not statistically different from one (i.e. $\sum_{i=1}^{p}\beta_i = 1$), under the null. From the results presented in Table 2, it shows the inflation rates are highly persistent. Regardless of the deterministic components, the headline inflation rate had the highest amount of persistence followed by the trimmed mean, Headline excluding 20 most volatile items and the official core inflation rates respectively. On if the magnitudes are statistically less than one, only the official core inflation rate was found to be mean reverting at significance value of 10 per cent. Headline, Trimmed mean and Headline excluding 20 most volatile items were not mean reverting, indicating that the impact of any policy action on the series would be permanent. Hence, we find evidence that alternative core measures track the persistence of headline inflation rate better than the official core inflation rate.

Table 2. Persistence test using Full Sample

Inflation		**With Intercept**	**With Intercept & Trend**
Headline	$\sum_{i=1}^{p}\beta_i$	0.9646[A]	0.95080[A]
		(0.0313)	(0.0358)
	$\sum_{i=1}^{p}\beta_i = 1$	1.2037	1.3662
		[0.2624]	[0.2458]
Headline ex food (Official Core)	$\sum_{i=1}^{p}\beta_i$	0.9394[A]	0.9388[A]
		(0.0312)	(0.0315)
	$\sum_{i=1}^{p}\beta_i = 1$	3.7437[C]	3.7510[C]
		[0.0564]	[0.0562]
Trimmed Mean	$\sum_{i=1}^{p}\beta_i$	0.9541[A]	0.9385[A]
		(0.0555)	(0.0625)
	$\sum_{i=1}^{p}\beta_i = 1$	0.6813	0.9656
		[0.4115]	[0.3286]
Headline excluding 20 most volatile Items(89%)	$\sum_{i=1}^{p}\beta_i$	0.9518[A]	0.9368[A]
		(0.0570)	(0.0674)

	0.7122	0.8778
$\sum_{i=1}^{p} \beta_i = 1$	[0.4011]	[0.3515]

Note: (where () are standard errors of the associated $\sum_{i=1}^{p} \beta_i$, [] are p=values and A, B, C represent statistical significance at 1%, 5% and 10% respectively).The optimal lag length for the traditional approach is determined using the AIC values and using the maximum lag of three (3). Values in "( )" are standard errors of the associated $\sum_{i=1}^{p} \beta_i$.

5. Conclusion

Core rates of inflation have always performed an essential role in the conduct of monetary policy at various central banks around the world. In a few of such as Canada, Japan and Poland, they have become veritable guides for monetary policy decisions and as a communication tool. The findings from the study indicate that non-traditional core measures track inflation better than the official core inflation rate. The trimmed mean most accurately tracks trend in headline inflation rates.

To diminish the risk that each measure of core inflation will at specific periods be misrepresenting fundamental inflation developments, a set of different measures will need to be used. In addition, the information obtained through using different measures of core inflation will help the central bank in deciding when they can understandably have confidence in a given core inflation measure.

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Appendix

A1: Volatility and Persistence of CPI components

Volatility and Persistence of CPI components			
Component	**Weight**	**Standard deviation (percent)**	**Peristence Rank (1=highest)**
Electricity	16.2	32.3	17.0
Musical Instrument	0.0	23.4	66.0
Motor cars	8.1	13.0	36.0
Passenger transport by sea and inland waterway	0.1	9.9	25.0
Cleaning, repair and hire of clothing	5.1	8.5	39.0
Recreational and sporting services	0.5	7.7	63.0
Domestic services and household services	0.6	7.2	44.0
Miscellaneous services relating to the dwelling	1.3	7.1	58.0
Passenger transport by road	24.3	6.8	27.0
Games of chance	0.1	6.3	64.0
Other services in respect of personal transport equipment	0.1	6.2	43.0
Photographic Development	0.2	6.0	67.0
Catering services	1.8	5.7	51.0
Fuels and lubricants for personal transport equipment	14.2	5.6	10.0
Oils and fats	36.3	5.6	38.0
Liquid Fuel	37.9	5.5	40.0
Solid Fuels	22.5	5.3	4.0
Wine	1.1	5.2	50.0
Audio-visual, photographic and information processing equipment	6.1	5.2	65.0
Fish	44.5	5.2	20.0
Maintenance and repair of personal transport equipment	0.2	4.9	8.0
Repair of Furnure	0.2	4.9	52.0
Gas,	1.0	4.7	21.0

Household textiles	1.6	4.6	26.0
Clothing materials, other articles of clothing and clothing accessories	25.1	4.5	12.0
Books & Stationeries	39.4	4.5	7.0
Bread and cereals	216.7	4.5	3.0
Paramedical services	6.8	4.4	48.0
Appliances, articles and products for personal care	0.1	4.3	62.0
Meat	47.8	4.3	19.0
Garments	29.8	4.2	15.0
Shoes and other footwear	13.4	4.1	13.0
Vehicle Spare Parts	10.0	4.1	18.0
Spirits	1.1	4.1	34.0
Coffee, tea and cocoa	6.2	4.0	60.0
Furniture and furnishings	8.4	3.9	28.0
Medical Services	9.0	3.9	32.0
Actual and imputed rentals for housing	77.4	3.9	57.0
Narcotics	4.2	3.9	5.0
Glassware, tableware and household utensils	3.5	3.7	42.0
Jewellery, clocks and watches	0.4	3.7	1.0
Milk, cheese and eggs	12.7	3.6	16.0
Carpets and other floor coverings	0.4	3.5	49.0
Potatoes,Yam & Other Tubers	60.6	3.5	14.0
Non-durable household goods	30.5	3.4	46.0
Passenger transport by air	1.7	3.4	6.0
Dental services	0.2	3.4	61.0
Other services n.e.c.	6.7	3.4	35.0
Water supply	11.0	3.4	54.0
Repair & hire of Footwear	3.1	3.3	47.0
Bicycles	2.8	3.3	30.0
Sugar, jam, honey, chocolate and confectionery	11.1	3.2	33.0
Motor cycles	3.7	3.1	9.0
Tobacco	4.5	3.0	22.0
Pharmaceutical products	12.6	2.9	59.0
Vegetables	54.4	2.7	2.0
Repair of household appliances	1.4	2.4	55.0
Telephone and telefax services	3.6	2.4	24.0
Telephone and telefax equipment	2.3	2.3	11.0
Soft Drinks	4.7	2.2	56.0
Insurance	0.8	2.2	31.0
Hairdressing salons and personal grooming establishments	8.7	2.1	23.0
Accommodation services	10.3	2.1	41.0
Hospital services	1.4	2.1	45.0
Major household appliances whether electric or not	3.6	2.1	37.0
Fruit	23.0	2.0	53.0
Postal services	0.9	1.9	29.0
Overall CPI Items	1000.0	3.4	