RESERVE BANK OF FIJI

Economics Group

Working Paper

Reassessing Fiji's Core Inflation Measures

Isoa Wainiqolo Apenisa Tuicakau

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Abstract

This paper reassesses the appropriateness of Fiji's current core inflation measures as recommended by Dewan et al (2003) using an updated Consumer Price Index (CPI) data series and provides a clearer framework of selecting core inflation measures. Conditions set out in Marques et al (2003) were used as the initial benchmark. Tests by Cogley (2002) and Roger (1998) were then carried out. While several conditions overlapped between the three papers, the predictability element in the former and the communication requirement[1] in the latter were emphasised. The smoothness of the preferred core inflation measures was then examined. Results suggest that the 15 percent symmetric trimmed mean measure remains relevant.

[1] Roger (1998) highlighted three desirable properties of a core inflation measure which include robustness and unbiasedness, timeliness and credibility where communication comes in.

1.0 Introduction

The role and significance of prices is clearly understood and evident in many economies. Price movements transmit appropriate market information to consumers, suppliers and other market participants. Price changes also act as a signal, clear disequilibrium and provide direction for players in the market to maximise welfare and profit – this is the beauty of the price mechanism. However, high and rising inflation has economic costs, for example, menu costs which are the costs to firms resulting from changing their prices. With high and rising inflation, firms must change their prices often to keep up with economy-wide changes. Moreover large fluctuations in prices create uncertainties and distort market activities such as investment. Accordingly, most central banks aim for price stability and target an explicitly defined inflation rate.

Price movements occur because of changes in demand and supply of goods and services. Friedman (1969) notes that price disturbances are the result of two independent forces, a monetary phenomenon and special circumstances such as oil price shock. The former transmits the result of market interaction between suppliers and consumers of goods and services (demand shocks) while the latter affects firms' productive capacity (supply shocks), e.g. commodity price changes, climatic events. Central banks with a price stability objective seek to contain inflationary or deflationary price pressures arising from changes in demand and disentangling the effects on prices from the two forces presents a huge and an ongoing challenge for central banks around the world (see Blinder (1997) and Roger (1997) on related arguments). A second challenge central banks face is that prices are

slow to adjust and monetary policy only affects inflation with a lag. This lag in the monetary transmission mechanism has motivated the construction of core measures of inflation.

Many researchers have tried to formalise the concept and definition of core inflation, which is commonly referred to as the portion of price movements that are not transient in nature and therefore relevant for monetary policy. Monetary policy cannot affect transient price changes because of the lags in the monetary transmission mechanism. The definition implies that core inflation does not reflect all the changes in the current cost of living given that it only captures a portion of the overall change in prices, but rather it gives some sense of direction regarding the underlying movement of prices in the long-run that the central bank can influence.

The literature provides many approaches on how to measure core inflation. Common among central banks is the ad hoc removal of some observable, transient price movements, often interpreted as "unwanted noises" in the measurement of the exact trend of inflation. A collection of papers by the Bank for International Settlements (1999), provides a comprehensive review of various core inflation measures such as exclusion-based, economic approach and statistical/limited influence measures. Statistical approaches such as the trimmed mean and median inflation are also widespread. In particular, Bryan and Pike (1991) and Bryan and Cecchetti (1993) support the use of median price changes as opposed to other statistical techniques to measure core inflation. They provided evidence supporting the use of weighted median and the trimmed mean rather than selective exclusion when measuring underlying inflation. Nevertheless, despite the improved strength

of these limited influence estimators, they provided no theoretical relations behind the concept of core inflation and their long-run behaviours, a subject that is more relevant for central bankers. During the 1990s, studies advanced towards decomposing transitory and permanent effects of inflation using econometrics and conditionality of the theoretical long-run relationships between certain economic variables. Quah and Vahey (1995) used a vector autoregression (VAR) system for the United Kingdom, which was subsequently used by Dias and Pinheiro (1995) for Portugal, Fase and Folkertsma (1996) for the Netherlands, Jacquinot (1998), and Gartner and Wehinger (1998) for a group of countries in the European Union. The approach is consistent with the monetary view of inflation although the relationship was not imposed directly in the model.

Despite statistical and econometric advancements towards measuring core inflation, there is no broad consensus on the most appropriate measure to use for policy purposes. This indicates the need for a broad consideration of all methods bearing in mind the monetary policy framework and objectives, on an individual country basis. This background forms the motivation of this paper, which is to review the current measurement of core inflation in Fiji.

The rest of the paper is divided into different sections as follows: Section 2 discusses the data coverage and construction, Section 3 describes the core inflation measures investigated in this paper, Section 4 presents the evaluation methods and results while Section 5 concludes the paper.

2.0 Data Coverage and Construction

The paper uses monthly CPI data series for the period January 1995 to March 2013 which includes two CPI bases – 1993 and 2005.[2] There were three layers of groupings –group, subgroup and items level. The various series were first linked. Several scenarios were encountered during the linking process. Linking was necessary because longer time series are needed in the econometric estimations. A series can be common in both the CPI bases,[3] a series can be discontinued in the new base, a new series can be introduced in the new base and a series can be split or combined in the new base. All the five scenarios were treated differently. In the first case, the series was spliced using the overlapping months. For the second and third scenarios, the series were kept in its current form and seasonally adjusted if it was long enough (at least five years of data). For the fourth and fifth scenarios, a composite index was formed for the latter while the former was seasonally adjusted separately if the series was deemed long.

At this early stage, it was clear that focussing on subgroups level would be most efficient. Group levels were too aggregate to be useful for core inflation analysis while focussing on items level (235 items under the 2005 base) would complicate the analysis.

The subgroup series was then adjusted in periods where the shocks to the series and their magnitudes were known. These shocks included changes to indirect taxes (Value Added Tax) & subsidies, currency devaluations and structural changes (mostly for utilities).

[2] While the 2008 and 2011 CPI bases were also considered, detailed CPI information is not available thus restricting core inflation analyses.
[3] The level of comparison goes up to quantity (e.g. kilograms, litres) level.

Price controls on imported commodities were also considered as shocks to the series. Consequently, this was assessed based on how these controls significantly hindered the transmission of global prices to domestic prices.[4] Two major commodities: fuel & wheat, accounting for more than 16 percent of the 2005 CPI basket, were examined. While the outcomes were not representative of all price-controlled items, the study revealed that price controls only delays the price transmission in Fiji rather than eliminating them. The duration of lags depends on the frequency of the review. Accordingly, all the series were not adjusted for price control reviews.

In line with Roberts (2005), all the series were then tested for seasonality instead of having a seasonally adjusted series as a potential core inflation measure. Three criterions were used: seasonality assuming stability, nonparametric test for the presence of seasonality assuming stability and moving seasonality test. If seasonality patterns were identified in the series at the 1 percent or 5 percent statistical significance levels, then the adjusted series would be used. If there was no evidence of seasonality in the data, then the unadjusted series were used. This method ensures that as much as possible, all relevant information in the data is preserved in the analysis. The paper used the first criteria as the main yardstick for selection.

The Fiji Bureau of Statistics also provides a seasonally adjusted inflation series in its CPI publications. However, the method of seasonal adjustment is unknown and seasonal adjustment was carried out irrespective of the variations in each category. In addition, in this paper, specific adjustments

[4] A separate note on price controls is provided in the Appendix.

were carried out prior to that step. As such, the methodology was not considered.

3.0 Core Inflation Measures

The following measures of underlying inflation were derived in this paper:

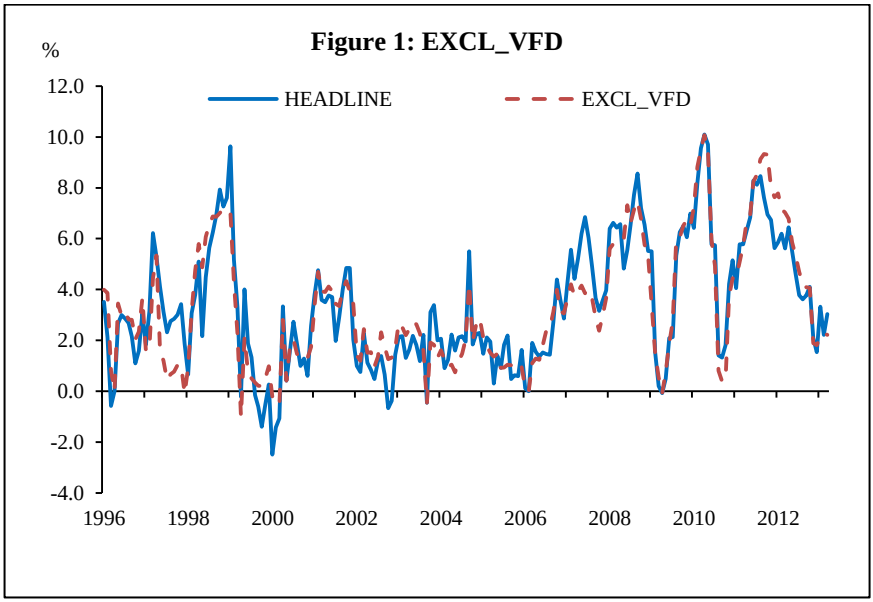
a) Exclusion-based Measures

As in conventional methods, exclusion-based core inflation measures were selected based on past knowledge of the local economy's inflation dynamics, in particular price volatility. Given the goal of finding underlying inflation trends, volatile subgroups such as food and energy-related items are usually excluded first.[5] In Fiji, the heavy reliance on these two categories means the exclusion of a significant portion of the CPI from the core inflation measure.[6]

i. CPI excluding volatile food components (EXCL_VFD)

This measure excludes volatile categories such as fruits, vegetables & root crops and yaqona. These categories equate to 10 percent of the 2005 base CPI basket.

[5] Ideally, tracing the number of times an item(s) falls within a threshold of say 15% of the two edges can assist in pinpointing the exact items to be excluded.
[6] Focussing on items level has an edge here as excluding subgroups can mean excluding certain items that are not necessarily volatile.

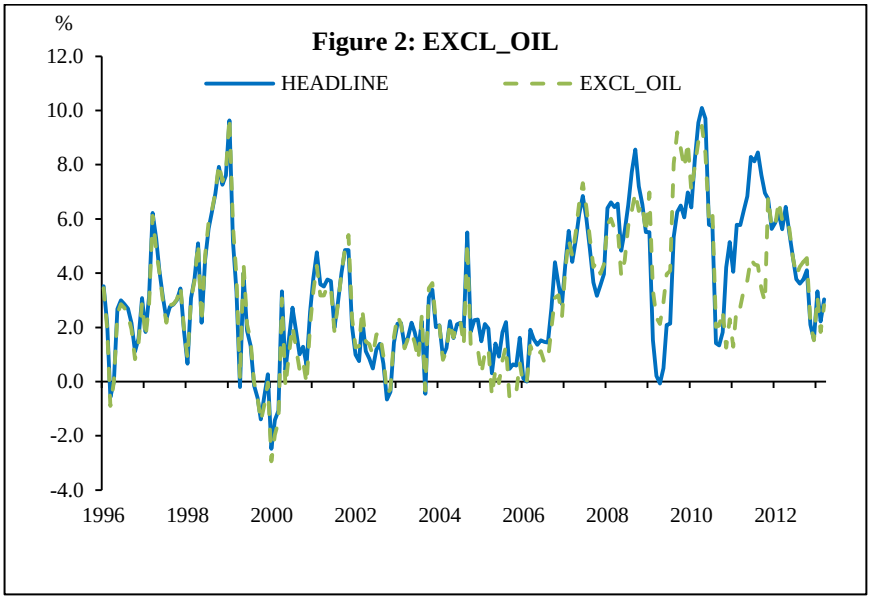


Source: Fiji Bureau of Statistics, Reserve Bank of Fiji, Authors' Calculations

Fiji is prone to numerous climatic events such as floods, natural disasters and dry spells, which affect the supply of local agricultural produce such as fruits, vegetables, root crops and yaqona and thus its prices. Past experiences have shown that these categories have caused major swings in headline inflation, with the impact lasting for a year.[7] The strong correlation between the headline inflation and exclusion-based series suggests that while the excluded categories are important they may not necessarily be the main drivers of headline inflation during the period of investigation.

ii. CPI excluding fuel components (EXCL_OIL)

[7] Given that the focus is on annual changes.

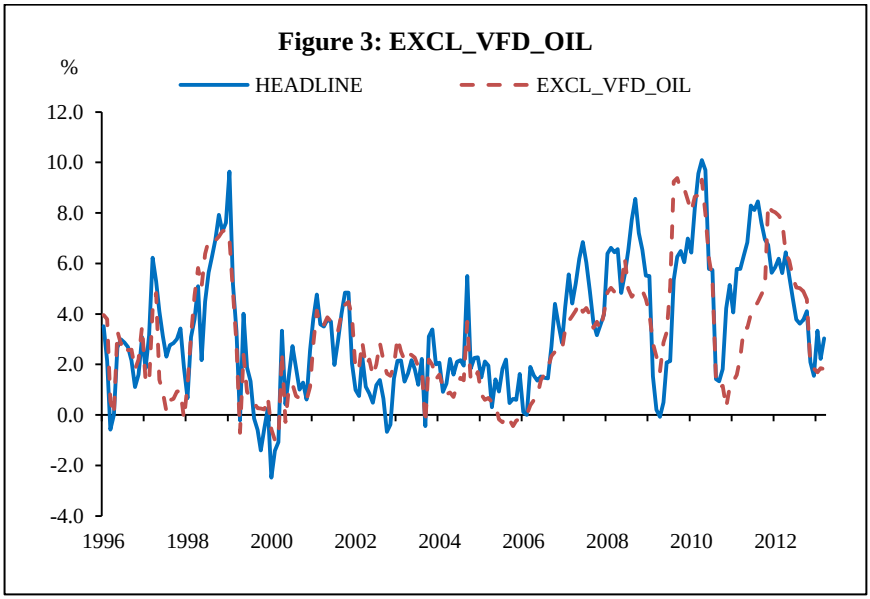


Source: Fiji Bureau of Statistics, Reserve Bank of Fiji, Authors' Calculations

The second exclusion-based measure considered excludes heating & lighting and service & parts which equate to 14 percent of CPI weight. With Fiji's heavy reliance on oil imports, fluctuations in oil prices affect headline inflation. However, Figure 2 above shows that the impact of oil prices was not so prominent prior to 2000. Notable difference was recorded during 2008 in line with the global commodity price shock. The graph also depicts the prevalence of second round effects of increases in oil prices, which are not discounted by this measure.

iii. CPI excluding volatile food and fuel components (EXCL_VFD_OIL)

This measure is an extension of the first two measures of core inflation, excluding fuel and volatile food items.



Source: Fiji Bureau of Statistics, Reserve Bank of Fiji, Authors' Calculations

Theoretically and by construction, this measure should be a natural choice among the three exclusion-based core inflation measures. However, by observation, the series remains volatile throughout the sample period. This led to the consideration of other methods.

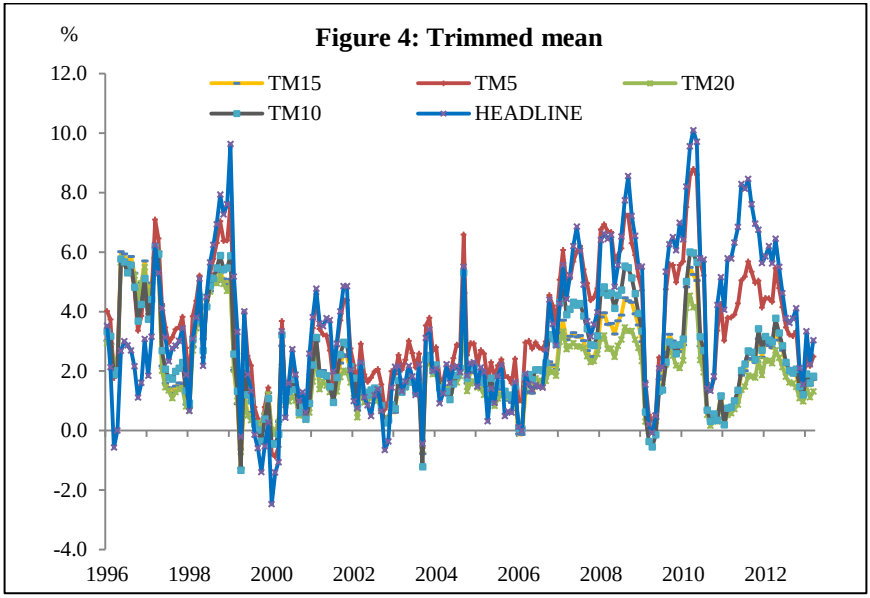
b) Trimmed Mean Measures

i. Symmetric trimmed means (5%, 10%, 15% & 20%)

Calculating the trimmed mean measures is straightforward. For the symmetric trimmed measures, the monthly percent changes for the 60 subgroups were first calculated and ranked in ascending order. For the 5 percent trimmed mean measure, cumulative weights in the top 5 percent and bottom 5 percent (after 95 percent) were then excluded and the remaining categories reweighted/redistributed. The weighted average of the remaining

series then gives the monthly price movements. A base period is then assumed and the series adjusted by the subsequent monthly price movements. The annual price changes then become the trimmed mean inflation for that period. The same method was applied to arrive at the 10 percent, 15 percent and 20 percent trimmed mean measures.

Dewan et al (2003) constructed the 5 percent (TM5), 10 percent (TM10) and 15 percent (TM15) symmetric trimmed mean measures. In this study, we constructed the same measures with the addition of a 20 percent (TM20) calculation, mainly to test if it provided better results.[8]



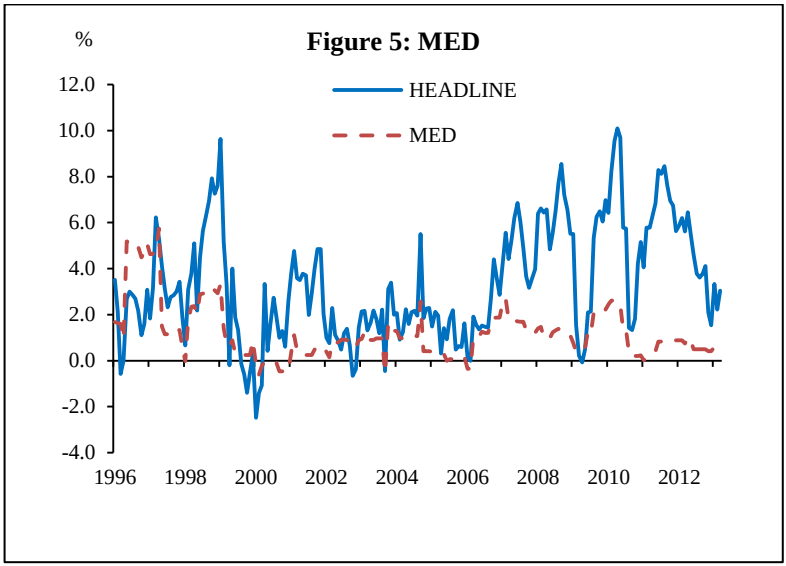
Source: Fiji Bureau of Statistics, Reserve Bank of Fiji, Authors' Calculations

[8] These selections were arbitrary. Ideally, having a program that determines the optimal trimmed mean percentage by meeting certain evaluation criteria can assist in ensuring that the weight of the remaining subgroups is sufficiently large enough. Using the 15 percent and 20 percent trim takes out a significant portion of the CPI basket.

As expected, given that trimmed means are statistical measures without much theoretical backing, all the four measures moved in line with headline inflation but at varying degrees. Unlike earlier measures, trimmed mean inflation always falls below headline inflation.

Weighted Median (MED)

This measure, also known as the 50 percent symmetric trim, is derived from the monthly percent change of the series that matched the 50th percentile of the ranked distribution. It takes the monthly change that corresponds to the 50 percent symmetric mean.



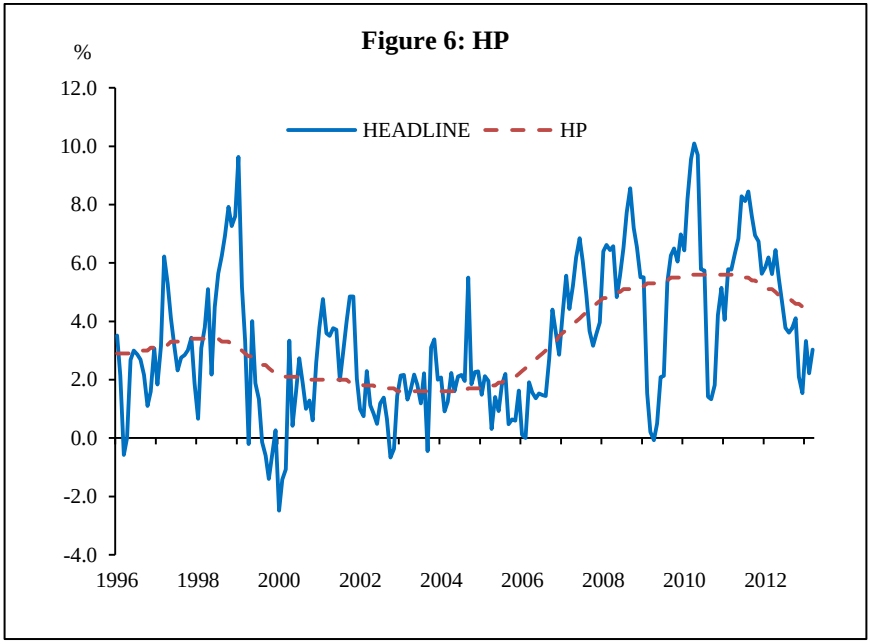
Source: Fiji Bureau of Statistics, Reserve Bank of Fiji, Authors' Calculations

As shown in Figure 5, the measure was lower than headline inflation in most periods. This reflects two likely scenarios: inflation was dominated by few significant price hikes or inversely, there were more periods of negligible price movements.

Hodrick-Prescott (HP) Trend

This series is a result of the HP technique applied to the headline inflation using the standard smoothing parameter of 14400 for monthly data.

Figure 6: HP



Source: Fiji Bureau of Statistics, Reserve Bank of Fiji, Authors' Calculations

While a smoother series, such as Figure 6, would be preferred for future policy settings and forecasting, it is too detached from the real inflation dynamics in Fiji.

4.0 Evaluating Core Inflation Measures

This paper uses the empirical conditions set out in Marques et al (2003), Cogley (2002) and the properties of good core inflation measures set out in Roger (1998) to narrow down the preferred measure for Fiji.

Marques et al (2003)[9] *criteria*

Headline inflation, π_t, can be defined as the sum of a permanent/core component, π_t^*, and a temporary component, u_t such that

$$\pi_t = \pi_t^* + u_t \quad (1)$$

Condition 1:

π_t^* is I(1) (i(a)) and π_t and π_t^* (i(b)), should be cointegrated with (ii) u_t, a stationary variable with zero mean.

Both the conditions were tested for unit roots.

Condition 2:

There has to be an error correction mechanism between headline and core inflation thus any deviation of headline inflation from the core is deemed temporary.

$$\Delta\pi_t = \sum_{j=1}^{m} \alpha_j \Delta\pi_{t-j} + \sum_{j=1}^{n} \beta_j \Delta\pi_{t-j}^* - \gamma(\pi_{t-1} - \pi_{t-1}^*) + \varepsilon_t \quad (2)$$

This means that $\gamma_t \neq 0$. In addition, the causality running from headline inflation to core inflation needs to be ruled out.

[9] These conditions have been deliberated extensively in most core inflation papers. As such, only a brief description of all the conditions is provided in this paper.

To test this condition, the t-statistic was used.

Condition 3:

This condition requires that the core inflation candidate must be strongly exogenous i.e. it is not influenced in any way by headline inflation in the long run.

$$\Delta\pi_t^* = \sum_{j=1}^{r} \delta_j \Delta\pi_{t-j}^* + \sum_{j=1}^{s} \theta_j \Delta\pi_{t-j} - \lambda(\pi_{t-1}^* - \pi_{t-1}) + \eta_t \quad (3)$$

To test this condition, the t statistic is used to gauge if the coefficient of $\hat{\lambda} = 0$ and the F statistic is used to test if the coefficient of all lags of inflation equals zero (i.e. $\theta_1 = \theta_2 = \cdots \theta_s$ provided $\hat{\lambda} = 0$).

Cogley (2002) criteria

Cogley (2002) tested the predictive ability of the core inflation measure. The test is on whether $\emptyset_t$, the current deviation from headline inflation can be a predictor of future changes in headline inflation, μ, where $\mu = \pi_{t+H} - \pi_t$. Specifically, the test requires carrying out a combined Wald test on the null hypothesis $\alpha = 0$ and $\beta = -1$.

$$\mu_t = \alpha_H + \beta_H(\emptyset_t) + u_{t+H} \quad (4)$$

The first condition is a drop out provided that if μ_t and $\emptyset_t$ are mean zero. The second condition confirms that if core inflation is a good indicator of current inflation, then any deviation should self-correct. If the coefficient is less than 1 in absolute terms, then core inflation will overstate future changes

in headline inflation and vice-versa. Ideally, the coefficient should lie between zero and 1.

This test was carried out with leads going up to 12 months (one year). If the F-statistic is insignificant or we fail to reject the null hypothesis at the usual significance levels of 5 percent and 1 percent within the time frame, then the core inflation measure is a good predictor of headline inflation.

Roger (1998)

Roger (1998) highlighted numerous desirable properties of core inflation measures such as robustness, unbiasedness, timeliness and credibility. While these conditions can easily be satisfied, this paper focuses on the communication property i.e. whether the measure selected can be easily relayed to the public. While this does not require an empirical test, it provides a policy and communication check on the clarity and reliability of the core inflation measure from the viewpoint of the general public. This check was carried out on core inflation candidates that passed the Marquees et al (2003) and Cogley (2002) conditions.

Results

Table 1 and 2 shows that only the 15 percent (TM15) and 20 percent symmetric trimmed mean (TM20) and the median (MED) measures passed all the conditions set out in Marques et al (2003) and Cogley (2002).[10] In line with the desirable communication element in Roger (1998), the median measure (MED) would be the preferred methodology given the general public's better understanding of the measure, as it is a concept introduced in

[10] The three measures also noted the lowest level of deviation from headline inflation (Table 4).

the early levels of Fiji's education system.

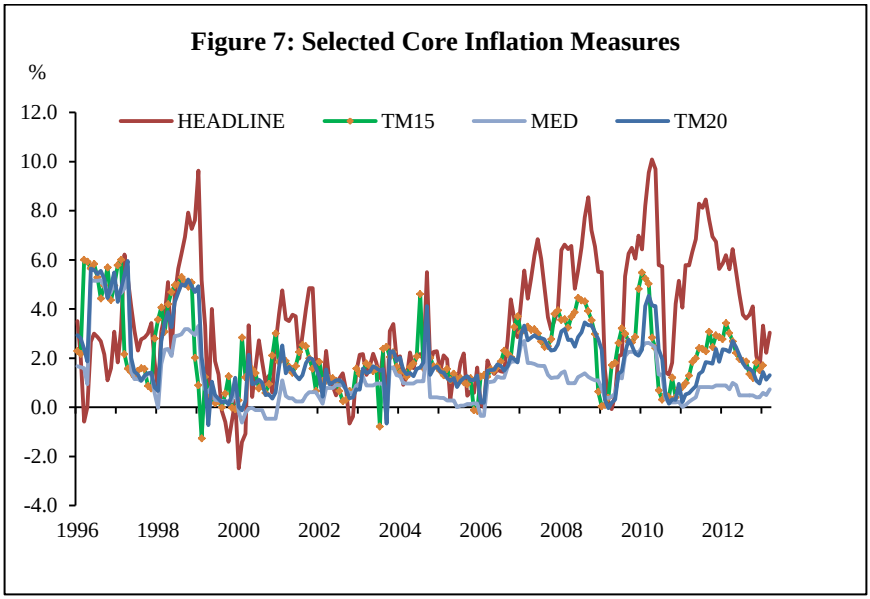
Table 1: Evaluation of Core Inflation Measures using the Marques et al (2003) Criterion									
Condition 1 (i): π_t^* is zero-mean stationary. [11]									
	EXCL_VFD	**EXCL_OIL**	**EXCL_VFD_OIL**	**TM5**	**TM10**	**TM15**	**TM20**	**MED**	**HP**
t-stat	-3.3	-4.3	-2.3	-4.8	-4.7	-4.3	-4.2	-3.3	-2.8
Probability	0.017	0.001	0.164	0.000	0.000	0.001	0.001	0.015	0.054
Condition met:	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Condition 1 (ii): u_t is zero-mean stationary.									
t-stat	-3.8	-2.8	-4.9	-2.9	-3.0	-3.3	-2.3	-3.7	-5.5
Probability	0.004	0.057	0.000	0.052	0.040	0.015	0.180	0.005	0.000
Condition met:	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No
Condition 2: $\Delta\pi_t^*$ is an attractor for π_t.									
t-stat	3.9	0.8	3.4	1.2	1.8	2.4	2.6	3.1	6.4
Probability	0.00	0.44	0.00	0.23	0.08	0.02	0.01	0.00	0.00
Condition met:	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Condition 3(i): Weak exogeneity. $\gamma_t = 0$									
t-stat	0.7	-1.0	-0.3	1.2	1.2	1.6	1.7	1.7	0.8
Probability	0.50	0.34	0.76	0.23	0.24	0.10	0.08	0.09	0.44
Condition met:	No	No	No	No	No	Yes	Yes	Yes	No
Condition 3(ii): Strong exogeneity. $\theta_t = 0$ given $\gamma_t = 0$									
F-stat	0.16	2.23	0.00	3.64	1.18	0.01	1.97	1.68	0.03
Probability	0.7	0.1	1.0	0.1	0.3	0.9	0.2	0.2	0.9
Condition met:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Condition 3(ii): Strong exogeneity. $\theta_1 = \theta_2 = \theta_3 = \theta_4 = 0$ given $\gamma_t = 0$									
F-stat	3.94	0.77	2.69	2.55	0.94	0.85	0.84	0.91	1.69
Probability	0.0	0.5	0.0	0.0	0.4	0.5	0.5	0.5	0.2
Condition met:	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes

[11] Detailed unit root and Engle-Granger Cointegration test results are provided in Table 7 and 8.

Table 2: Cogley (2002) Test Wald F Statistics p-values

Horizon	EXCL _VFD	EXCL _OIL	EXCL _VFD_ OIL	TM5	TM10	TM15	TM20	MED	HP
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	0.2283	0.0000	0.0000	0.0016	0.0000	0.0000	0.0000	0.0000	0.0000
4	0.2071	0.0000	0.0000	0.0320	0.0000	0.0000	0.0000	0.0000	0.0049
5	0.2128	0.0005	0.0005	0.2830	0.0000	0.0000	0.0000	0.0000	0.3834
6	0.3069	0.0026	0.0035	0.9511	0.0003	0.0003	0.0000	0.0000	0.3594
7	0.1063	0.0095	0.0028	0.4814	0.0031	0.0030	0.0006	0.0000	0.0266
8	0.0133	0.0261	0.0009	0.2014	0.0201	0.0184	0.0048	0.0006	0.0006
9	0.0008	0.0427	0.0001	0.0840	0.0592	0.0436	0.0130	0.0019	0.0000
10	0.0001	0.0763	0.0000	0.0296	0.1695	0.1088	0.0388	0.0091	0.0000
11	0.0000	0.0954	0.0000	0.0137	0.3145	0.1719	0.0716	0.0244	0.0000
12	0.0010	0.0832	0.0001	0.0055	0.6441	0.4198	0.2453	0.1573	0.0000
Condition met:	No	No	No	No	Yes	Yes	Yes	Yes	No

However, Figure 7 shows that the median measure is way out of line with headline inflation in certain periods therefore may not be seen as reliable by the public.



Source: Authors' Calculations

Conventionally, a smoother core inflation measure would be preferred for monetary policy purposes. Therefore, using the Mean Absolute Deviation (MAD) and Root Mean Square Error (RMSE) (Table 3), the deviation of core inflation from a measure of trend inflation (a 3-month moving average in this paper, now referred to as the reference series (REF)), was determined, revealing that the 15 percent symmetric trimmed mean was the preferred measure.

Table 3: Smoothness vis-à-vis 3-Month Moving Average Inflation

	TM15	TM20	MED
MAD	1.7	1.9	2.5
RMSE	2.3	2.5	3.2

In addition, the measure has a stronger correlation with both the headline inflation (Table 5) and reference series relative to the other two candidates (Table 6).

Out of the three exclusion based measures, EXCL_VFD_OIL would have been the natural choice as it excludes all fuel, fruits, vegetables & yaqona, all of which have been the cause of high inflation in recent periods. However, the series and its deviation from headline inflation are not cointegrated (Condition 1 in Marques et al (2003). This highlights several potential aspects of inflation dynamics in Fiji and similar countries. One, the subgroup categories not excluded in this measure is not necessarily stable. Two, the categories excluded in this analysis contain items that are not necessarily volatile but have significant weights thus affecting the deviation of the core inflation measure from headline inflation. Three, prices of items like yaqona and fruits & vegetables are not always volatile as perceived. Prices only spike for certain months and normalise thereafter. Therefore by construction, excluding them for the whole sample when the analysis is based on monthly variations is against the intention of underlying inflation. Four, the results question the rationale for price control (and the sentiments in the earlier sections of the paper) in that partial control give leeway for business sectors to make up lost margins in non-regulated and luxurious goods and services. Five, market forces have a more prominent role in determining prices than previously recognised. It has always been appreciated that prices in Fiji are somewhat exogenous given that Fiji is a small open economy. If this really was the case, then the series should have been cointegrated. Six, the sticky price theory is at work in particular in the non-regulated sector of the economy. This means once price increases in this segment, it sets new norm

over time and sellers somewhat set an unofficial price floor for these items thus there are less episodes of monthly price declines and unchanged prices.

These reasons partly explain why statistical measures such as symmetrical trimmed means are preferred in this context as it fixes the weight to be excluded throughout the sample.

To confirm this, several asymmetric trimmed mean measures were calculated. The results failed most conditions which from a theoretical viewpoint supports the sticky price theory in that there have been lesser occurrences of price declines than price increases.

5.0 Conclusion

Having the right benchmark of underlying inflation in Fiji is important for correct monetary policy recommendations, more so when inflation numbers are overshadowed by supply side constraints and one-off structural changes.

This paper supports the use of the 15 percent symmetric trimmed mean measure by the Reserve Bank of Fiji as in Dewan et al (2003).

Future work on underlying inflation in Fiji can focus on using a more updated series (e.g. the 2011 base) and testing all possible symmetric and asymmetric trimmed mean measures.

However, the paper also alludes to certain aspects of inflation dynamics in Fiji that may need to be further investigated; central to this is the role of partial price controls and how prices are set in the unregulated markets.

6.0 References

Bank for International Settlements, 1999. Measures of Underlying Inflation and Their Role in the Conduct of Monetary Policy, *Proceedings of the workshop of central-bank model builders held at the BIS* on 18–19 February 1999, Basle, Switzerland.

Blinder A., 1997. Commentary, *Federal Reserve Bank of St. Louis Review*, 79, 157-160.

Bryan. M and Pike, C., 1991. Median price changes: an alternative approach to measuring current monetary inflation, *Federal Reserve Bank of Cleveland Economic Commentary*, December 1.

Bryan. M and Cecchetti, S.,1993. Measuring Core Inflation, *NBER Working Paper* No. 4303, issued March 1993

Cogley, T., 2002. A Simple Adaptive Measure of Core Inflation. *Journal of Money, Credit and Banking,* Volume 34, pp. 94-113.

Dewan, E., Gokal, V. & Hussein, S., 2003. Measurement of Underlying Inflation in Fiji. *Reserve Bank of Fiji Working Paper.*

Dias, F., and Pinheiro, M., 1995. Shocks and inflation, *Banco de Portugal, Economic bulletin*, December

Fase,M and Folkertsma, C., 1996. Measuring inflation: an attempt to operationalize Carl Menger's concept of the inner value of money, DNB-Staff Reports, 8/1997 in *Bank for International Settlements, 1999*.

Friedman,M.,1969. The Optimal Quantity of Money and Other Essays, *Chicago: Aldine Publishing Company*, p. 171

Gartner, C., and Wehinger, D., 1998. Core Inflation in Selected European Union Countries, Mimeo, *Oesterreichische Nationalbank*.

Jacquinot, P.,1998. L'inflation sous-jacente à partir d'une approche structurelle des VAR: Une application à la France, L'Allemagne et au Royaune-Uni, Notes d'études et de Recherche NER#51, Banque de France in *Bank for International Settlements, 1999*

Marques, C. R., Neves, P. D. & Sarmento, L. M., 2003. Evaluating Core Inflation Indicators.

Quah,D., and Vahey.SP., 1995. Measuring Core Inflation, *Economic Journal*, 105, 1130-1144.

Roberts, I., 2005. Underlying Inflation: Concepts, Measurement and Performance. *Reserve Bank of Australia Discussion Paper.*

Roger, S., 1997, A Robust Measure of Core Inflation in New Zealand, 1949-96, *Reserve Bank of New Zealand Discussion Paper* G97/7.

Roger, S., 1998. Core Inflation: Concepts, Uses and Measurement.

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7.0 Appendix

Part 1: Note on Price Controls in Fiji[12]

A. Background

The merits and demerits of price controls are well documented in the literature. Studies have also shown that the rationale for price control needs to be viewed on a country by country basis. In Fiji, the Fiji Competition Consumer Commission (FCCC) administers the price of certain goods and services, which accounts 48.6 percent of the weight in the CPI basket (41 items).

B. Types of Price Controls in Fiji

Generally, three methods of regulating prices are exercised in Fiji: (i) Fixed maximum wholesale & retail prices, (ii) Fixed percentage mark – up and (iii) maximum ex-factory prices.

(i) Fixed Maximum Wholesale & Retail prices

Under this category, the regulator generally pegs the maximum price that wholesalers and retailers can charge after considering the following: (a) the total cost in store for pricing of the goods of the wholesaler/retailer, (b) delivery cost of the wholesaler/retailer if it is separately invoiced from above, (c) the mark-up in addition to the sum of (a) and (b).

(ii) Fixed Percentage Mark Up

Similar to (i), the regulator only focuses on pegging (c).

[12] Based on the 2005 base CPI Basket.

(iii) Maximum Ex-factory

This category is only applied to manufacturing enterprises where the prices charged to buyers are controlled by the regulatory body.

C. Case Studies – A Simple Graphical Analysis

This section takes a closer look at the transmission of international commodity prices to domestic prices (in particular cereal and oil prices), through three case studies, to determine if the market is really "obstructed"[13] by a regulatory body in passing the additional input costs to consumers.

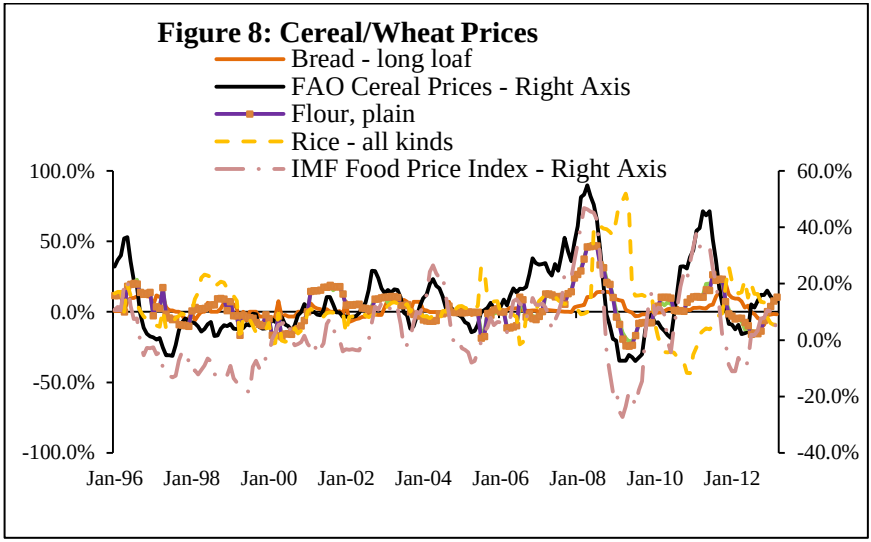
The three case studies are:

- Impact of increase in international wheat prices on domestic wheat-related products;
- Impact of increase in crude oil prices on fuel-related products; and
- Impact of international dairy prices on domestic dairy-related products.

Case Study (i): Direct impact of International Cereal Prices on Domestic Cereal Products (8.7% weight)[14]

[13] "*Obstruction*" in this section is defined as a case where the regulator explicitly does not allow the seller to change its pricing for duration of time it sees fit and indirectly forces the seller to absorb the additional costs.

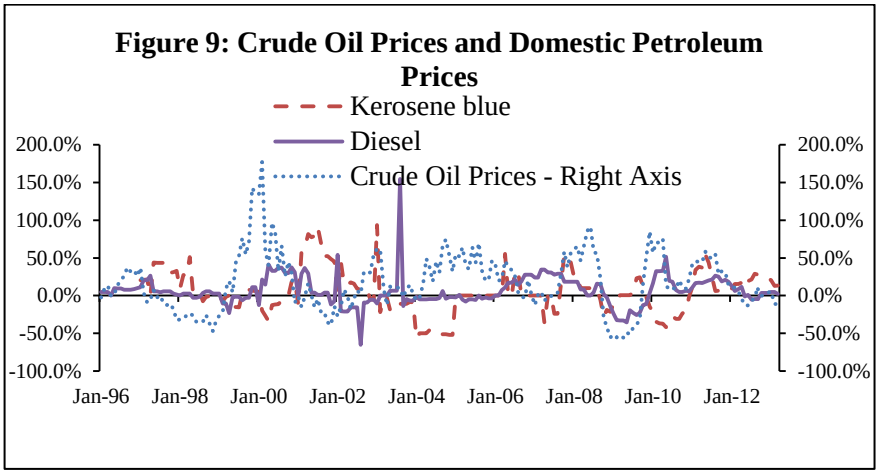
[14] Significant efforts were made to obtain relevant wheat/cereal prices/indices. The ones used in the chart below were the best available. As such, in summary we are making the strong assumption that Australian wheat prices (Australia is the main source market for wheat products in Fiji), would on average move in the same direction and magnitude as the FAO/IMF Index. For presentation purposes, some products were not included in the graph. Nevertheless, similar conclusions were arrived at.



Source: Fiji Bureau of Statistics, Reserve Bank of Fiji, Authors' Calculations

By focussing on the major turning points in Figure 8, it is clear that the pass through of international cereal and wheat prices to domestic prices is only delayed and not technically "obstructed".

Case Study (ii) (a): Direct impact of International Oil Prices on Petroleum products (7.2% weight)

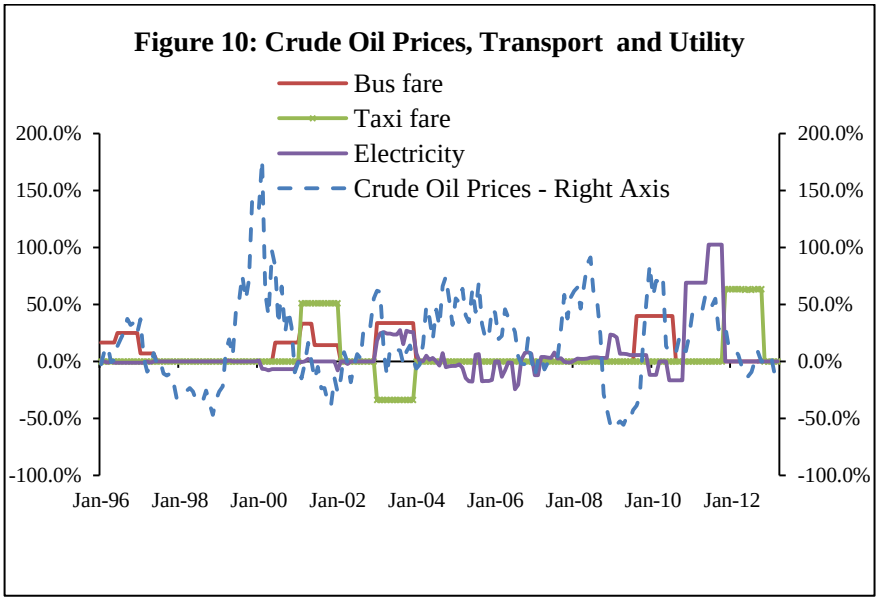


Source: Fiji Bureau of Statistics, Reserve Bank of Fiji, Authors' Calculations

Similarly, the increase in international oil prices is transmitted to domestic prices, although after a few months lag (Figure 9).

Case (ii) (b): Direct impact of International Oil Prices on Transport Means and Utility (12.4% weight)[15]

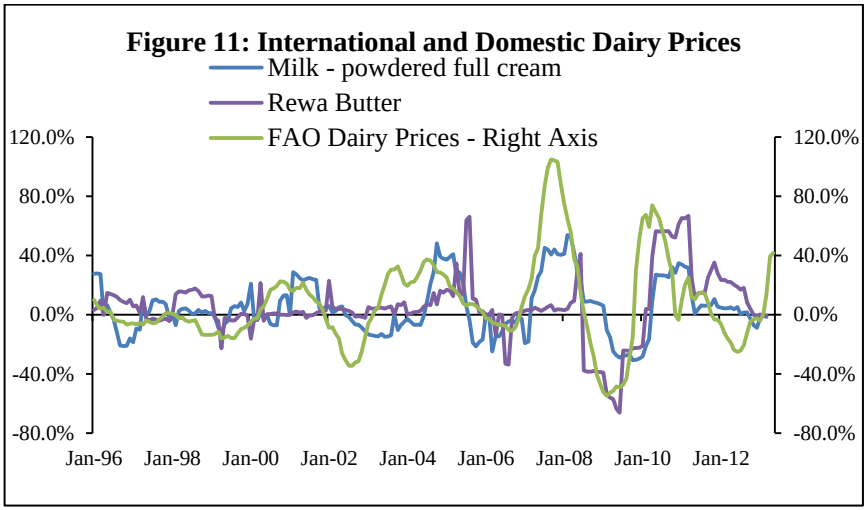
[15] Ideally, Singapore Crude Oil prices or even refined oil prices would be a more relevant indicator. Again, a lot of efforts were put in finding these prices but in the end, crude oil prices available from the New York Stock Exchange were used. As such we are making the assumption here that the trend and magnitude of the change in oil prices would have been similar to that in Singapore.



Source: Fiji Bureau of Statistics, Reserve Bank of Fiji, Authors' Calculations

While Figure 10 clearly shows that the transmission breaks down as a result of price controls, however, regulating prices of utilities is not new among many developed and developing economies.

Case (iii) (c): Direct impact of International Dairy Prices on Domestic Dairy-related products prices (3.6% weight)



Source: Fiji Bureau of Statistics, Reserve Bank of Fiji, Authors' Calculations

Figure 11 shows that the transmission of international dairy prices to domestic prices is delayed by one to two months.

D. Conclusion

While the proportion of regulated items in Fiji is relatively high (in terms of weight), at least half of them are only delayed price transmissions. From a cross country perspective, if these items are seen as effectively not price controlled, then the percentage of regulated items in Fiji is not too different from that reported in countries such as Brazil, Czech Republic, Mexico, Australia, New Zealand and United Kingdom.[16] Additionally, some countries (Australia for example) also control the price of utilities and gas (around 6.7% of the basket in Fiji), given the absence of adequate competition for the provision of those goods/services. Most countries also control the

[16] See Debelle, G, 2001, the case of inflation targeting in East Asian Countries, RBA.

prices of public transportation services which accounts to around 8.3 percent of Fiji's CPI (weight).

Part 2: Properties of Core Inflation Measures

Table 4: Frequency Distribution of Core Measures Descriptive Statistics

	CPI	EXCL_ VFD	EXCL_ OIL	EXCL_ VFD_ OIL	TM5	TM10	TM15	TM20	MED	HP
Mean	3.33	3.30	3.12	3.02	3.51	2.41	2.22	1.96	1.20	3.34
Median	2.90	2.70	2.80	2.50	3.22	2.04	1.90	1.60	0.90	3.10
Max	10.10	10.10	9.80	9.40	8.79	6.17	6.00	5.96	5.70	5.60
Min	-2.50	-1.00	-2.90	-1.00	-0.88	-1.34	-1.30	-0.73	-0.60	1.60
Std. Dev.	2.51	2.48	2.49	2.44	1.94	1.64	1.50	1.39	1.23	1.43
Skewness	0.43	0.69	0.44	0.74	0.26	0.45	0.68	0.96	1.65	0.33
Kurtosis	2.59	2.62	2.75	2.89	2.70	2.59	2.97	3.50	5.84	1.61

Table 5: Correlation Matrix

	CPI	EXCL _VFD	EXCL _OIL	EXCL _VFD _OIL	TM5	TM10	TM15	TM20	MED	HP
CPI	1.00	0.92	0.91	0.81	0.92	0.73	0.66	0.57	0.36	0.73
EXCL_ VFD		1.00	0.81	0.88	0.83	0.67	0.64	0.56	0.33	0.62
EXCL _ OIL			1.00	0.90	0.86	0.72	0.67	0.59	0.42	0.61
EXCL _ VFD_ OIL				1.00	0.76	0.66	0.65	0.58	0.41	0.58
TM15					1.00	0.92	0.86	0.80	0.61	0.52
MED						1.00	0.97	0.94	0.77	0.30
HP							1.00	0.98	0.84	0.27
TM5								1.00	0.90	0.19
TM20									1.00	0.13
TM5										1.00

Table 6: Correlation of Selected Core Inflation Measures with the REF series				
	REF	**TM15**	**TM20**	**MED**
REF	1	0.55	0.47	0.27

Table 7: Unit Root Tests on the Variables		
Variables (in log levels)	Augmented Dickey-Fuller Test	Phillips-Perron Test
HEADLINE	-4.201***	-4.160***
EXCL_VFD	-3.281**	-3.675**
EXCL_OIL	-4.294***	-4.097***
EXCL_VFD_OIL	-2.33	-3.549**
TM5	-4.775***	-4.700***
TM10	-4.653***	-4.645***
TM15	-4.337***	-4.371***
TM20	-4.202***	-4.221***
MED	-3.336**	-3.549**
HP	-2.842*	-0.668

The *, **, *** indicates rejection of the null hypothesis of a unit root at the 10, 5 and 1 percent significance level. From the inspection of individual series, both tests only include an intercept term. For the ADF tests, the respective lag length(s) were automatically selected based on the Schwarz Criteria, incorporated in *EViews 9.0*.

Table 8: Engle-Granger Cointegration Test Results		
Core Inflation Measure	**Coefficient**	**ADF Test Statistic for Residual I(0)**
	β	
EXCL_VFD	0.93	-3.58**
EXCL_OIL	0.91	-3.08*
EXCL_VFD_OIL	0.84	-3.46**
TM5	1.18	-3.70**
TM10	1.12	-3.44**
TM15	1.10	-3.39**
TM20	1.04	-3.19*
MED	0.73	-3.25*
HP	1.10	-3.25*
Notes: * and ** denotes significance at the ten and five percent significant levels.		