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Evaluating Core Inflation Measures in Pakistan

Muhammad Amin Khan Lodhi

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EVALUATING CORE INFLATION MEASURES IN PAKISTAN

Muhammad Amin Khan Lodhi
Research Economist
State Bank of Pakistan,
amin.lodhi@sbp.org.pk

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Contact for correspondence
Monetary Policy Department
State Bank of Pakistan
I.I. Chundrigar Road
Karachi.
Ph: +92 21 2453831, Fax: +92 21 9211472

Abstract

The concept of core inflation is getting common and several core inflation series have been estimated in Pakistan. However, no attempt has been made to study if these estimated series of core inflation are actually serving the purpose they were designed for. The main objective of this study is to evaluate core inflation measures in Pakistan on some absolute criteria. Nine different core inflation series have been tested for the three conditions proposed by Marques et al. (2000). Results suggest that none of the series based on excluding fixed items approach (one of which is also being used by SBP) satisfy these basic conditions. In contrast, all trim-based core inflation measures are satisfying basic conditions, but systematically underestimate true core inflation. For example, the currently used 20 percent trim-basket (10 percent from each end) by SBP underestimates true core inflation by 20 basis points on average.

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Evaluating Core Inflation Measures in Pakistan

1. Introduction

Price stability, if not the only, is one of the main objectives of monetary policy. However, it may not be desirable for monetary policy to respond to all the price changes. Since the main concern of monetary policy is to stabilize the underlying (long-run) inflation rate, monetary managers should ignore the temporary (short-term) non-monetary supply side changes in inflation. Monetary framework, therefore, requires an inflation measure that can mimic a true underlying long-term inflation trend. Due to a similar consideration, the concept of core inflation is gaining popularity value among central banks. The basic idea is to separate the transitory and permanent (core) component hidden in headline inflation. In fact, many central banks have started monitoring trends in some measures of core inflation along with movement in headline inflation.

The concept of core inflation is getting importance in Pakistan as well. The State Bank of Pakistan has added core inflation in the list of indicators for monetary management. SBP publications (in particular, Annual and Quarterly Reports on the state of the economy, and the Monthly Inflation Monitor) are regularly incorporating analyses on core inflation; besides reviewing trends in headline inflation.[1] The Economic Survey (ES), one of the important sources of economic data in Pakistan, began to report core inflation measures in 2004. More importantly, the concept of core inflation is also being picked up by the media. Now, news items, articles, and discussions on inflation also consider patterns in core inflation along with that of headline measure.

It is important to note that there is no unique way of estimating core inflation. Several methods have been adopted by different studies, starting from simple statistical techniques to complex econometric models (based on some established economic theory).[2] Core inflation measures in Pakistan, computed so far, are based on two widely used statistical approaches: first known as excluding fixed items approach and second based on limited influence estimator, in particular trimmed mean criteria.[3] The pioneer work, to estimate core inflation series in Pakistan, was done by Tahir (2003). Applying both the methods, the study estimated four alternative core inflation series. At present, SBP is monitoring two core inflation measures: first based on 20 percent

[1] SBP has started analyzing Non-food non energy CPI inflation in the bank's Annual and Quarterly Reports since 2003.
[2] For details see Clark (2001); and Mankikar and Jo (2004).
[3] For Details see Tahir (2003), SBP's Inflation Monitor (May 2006).

trimming (10 percent from each end) of the most volatile prices; while the second is computed by excluding food and specific fuel and energy items. Details of core inflation measures in Pakistan, being used today or in the past, are given in **Section 3**.

Given that various core inflation series have been estimated and are being used to analyze trends in inflation, especially by SBP, it is vital to check if the existing core inflation measures are truly representing the underlying inflation or not. However, no attempt has been made as yet to address this important question.[4] The main objective of this study is to fill this gap. The methodology proposed by Marques et al. (2000) is applied to evaluate nine alternative series of core inflation in Pakistan.

In this regard, time series data for extended periods (on consistent definition) of these core inflation measures were required. However, this was not readily available for most of the measures. For example, data on core inflation measures, currently being used by SBP, was available from November 2003 only. This study has first computed various core inflation monthly series from July 1992 to April 2006 (see **Annexure 1**), which is another important contribution of this study.[5] Moreover this paper has also computed two new trimmed-based core inflation series, by making slight changes in the current procedure being used at SBP.[6]

The rest of the paper is divided into four sections. The following section, after briefly reviewing the literature on the subject, explains the methodology applied in the paper to evaluate core inflation measures. Section 3 provides a list and brief description of different measures used to proxy core inflation in Pakistan. Section 4 reports the results and the last section concludes the paper.

2. Methodology

This section is divided into two sub-sections: the first will briefly review the literature on procedures adopted by some earlier studies; while the second section will explain the technique

[4] As discussed in the following section, Tahir (2003) applied various tests to measure the performance of the four estimated series, however, these tests only evaluate different series in relative terms and do not answer if the optimal series is actually a true representative of underlying (long-run) inflation or not.

[5] It may be important to note that data from two different baskets, CPI basket 1990-91 and CPI-basket 2000-01, have been used. For the period July 1992 to January 2002, data from the old basket is used; while for July 2002 onward period core inflation measures are based on the new basket. Due to non-availability of data for base year 2000-01, trim-based core inflation estimates for the period February to June 2002 are based on prices of overlapping items in the two baskets. Common items in the new and old baskets share 93.2 percent weight of the new basket.

[6] Details are given in **Section 3**.

adopted in this study.

2.1 Methodological Choices

As there is no unique way of estimating core inflation measures, similarly there is no standard way to test the performance of core inflation measures. Many studies that attempted to estimate core inflation measures also tried to evaluate the performance of their estimated series. Techniques used in these studies were mainly based on some properties that a potential core inflation series should exhibit. However, properties used for selection criteria in most of the studies can either be categorized as prerequisites for a potential core inflation estimator to show or can only be used to choose among alternative series of core inflation. For example, Roger (1997) defined four such characteristics;. a potential core inflation series should be timely; credible; verifiable; and understandable by the general public. Wynne (1999) further added that a core inflation measure should: be computable in real time; have a track record; be forward looking in nature; and have some justification from economic theory. While it is important that core inflation measures should display all or most of these properties, a more pertinent question, in evaluating a core inflation series, is that how well a core inflation measure estimates the underlying long-term inflation path. Performance of various core inflation measures in Pakistan on such desirable properties is summarized in **Annexure 2**.

Some of the studies tried to address this question by comparing trends in core inflation series with reference inflation measures (defined as an inflation indictor showing long-term series).[7] For example Bakhshi and Yates (1999) used 37 months centered moving average inflation as reference measure for comparing estimated core inflation measures. They selected the optimal core inflation estimator that best imitated the reference measure. Marques et al. (2000), while criticizing this approach, stated that "*the introduction of these so-called "reference measures" for inflation, on the basis of which the other indicators are evaluated, is never duly justified and so there is no guarantee that these indicators are useful references for the assessment of core inflation measures*".

Some other studies based their evaluation on the criteria on how closely estimated series move with overall (headline inflation). These studies computed the standard deviation of series showing difference of headline and core inflation measures. The optimal core inflation measure has been selected, for which value of the standard deviation was at the lowest. This approach can

[7] For example see Bryan and Cecchetti (1993); Coimbra and Neves (1997), and Bakhshi and Yates (1999).

probably be used for selecting the optimal series among various alternatives that are already fulfilling some basic criteria to qualify as the estimators of underlying inflation. This method itself is inconclusive in determining if the selected core inflation estimates are actually representing the true core inflation series or not. Tahir (2003) has used this approach to evaluate the performance of the four core inflation measures in Pakistan.

Few other studies also used basic statistical properties, such as mean and standard deviation of estimated series for core and headline inflation.[8] The idea is that in long time series (generally defined as 25 to 30 years in these studies), headline and core inflation should have the same mean, but with lower standard deviation of the latter. These properties may be necessary for core inflation measures to exhibit, but definitely not sufficient to ensure that the series is also representing true core inflation. Moreover, this procedure is of little use if such a longtime series is not available; as is the case in Pakistan.

Marques et al. (2000) proposed a series of tests that a potential core inflation estimator should satisfy in absolute term. The basic idea was to ensure a compulsory feature, i.e. headline inflation should converge to core inflation in the long run, but not vice versa. For this purpose, the study proposed the following three testable conditions: first; headline and core inflation should be co-integrated with unit coefficient; second, core inflation should be an attractor of headline inflation; and third, headline inflation should not be an attractor of core inflation. Details and rationale of testing these conditions are given in the following sub-section.

2.2 Methodology Adopted in this Study

In order to evaluate various core inflation measures in Pakistan, this study has used the methodology proposed by Marques et al. (2000). If we assume that at any given time t, the relationship between headline and core inflation can be summarized by the following mathematical expression:

$$\pi_t = \pi_t^* + \mu_t \qquad (1)$$

Where π_t and π_t^* stand for headline and core inflation measure at time t, while μ_t represents a transitory component. It is assumed that changes in μ_t are caused by factors such as seasonal price movements; one-off increases in administrative prices; and other temporary supply side

[8] For example see Clark (2001).

shocks; etc. If we further assume that π_t is integrated of order 1, i.e. I(1), which is actually the case in Pakistan, than according to the first condition proposed by Marques et al. (2000) the following two results must hold: first, potential core inflation series must be I(1); and second, π_t and π_t^* must be co-integrated with unit co-efficient, i.e. (π_t - π_t^*) is stationary with zero mean.

The key rationale of this condition is that it ensures headline and core inflation series exhibit similar trend in the long run. If (π_t - π_t^*) is not stationary for any core inflation series, then this simply implies that the series is not fully capturing permanent component in headline inflation. Thus it is not an unbiased estimator of true core inflation. In order to check this condition, Augmented Dickey Fuller (ADF) stationarity test is applied on (π_t - π_t^*); i.e.:

$$\Delta(\pi - \pi^*)_t = \alpha + \rho(\pi - \pi^*)_{t-1} + \sum_{j=1}^{n} \phi_j \Delta(\pi - \pi^*)_{t-j} + \xi_t \qquad (2)$$

While stationarity of (π_t - π_t^*) is a necessary condition, it is not sufficient to ensure that headline inflation will converge to the estimated core inflation series (in the long run). It is possible that any two series are *co-integrated* and move parallel to each other; or in other words α is statistically significant in equation 2. Thus, given that (π_t - π_t^*) is stationary, it is also desirable that α should be equal to zero.

The second condition, proposed by Marques et al. (2000), was to ascertain that headline inflation converges to core series in the long run. In order to test this condition the study proposed to estimate the following error-correction model:

$$\Delta\pi_t = \delta + \sum_{j=1}^{m} \beta_j \Delta\pi_{t-j} + \sum_{j=1}^{n} \chi_j \Delta\pi_{t-j}^* - \gamma(\pi_{t-1} - \pi_{t-1}^*) + \varepsilon_t \qquad (3)$$

And test the hypothesis that γ = 0. The rejection of hypothesis suggests that π^* is an attractor of π and headline inflation does converge to estimated core inflation in the long run. This is again a necessary condition that a core inflation measure must hold. As explained by Marques et al. (2000), if there is no reason to expect that π_t will converge to π_t^*, it is of no use to know if at a given point in time π_t^* is above or below π_t. However, if γ is statistically different from zero, it

ensures that if in a given period π_t is above (below) π_t^*, then sooner or later π_t will start to decrease (increase) and converge to π_t^*.

It is important to note that if π_t and π_t^* are showing different values at a given point in time, only the former should move to converge towards the latter or in other words π_t^* is strongly exogenous. Otherwise, it would be difficult to predict future path of π_t by looking at π_t^*. The third and the last condition of the methodology was to ensure that the estimated core inflation does not converge to headline inflation. The following error-correction model was estimated to test this condition.

$$\Delta\pi_t^* = \omega + \sum_{j=1}^{m} \varphi_j \Delta\pi_{t-j}^* + \sum_{j=1}^{n} \theta_j \Delta\pi_{t-j} - \lambda(\pi_{t-1} - \pi_{t-1}^*) + \nu_t \qquad (4)$$

The hypothesis to check is that $\lambda = 0$ and the failure to reject the hypothesis suggests that π_t^* is weakly exogenous. In order to ensure strong exogeneity, this condition further requires that π_t does not granger cause π_t^* or $\theta_1 = \theta_2 = ... = \theta_j = 0$ in equation 4.

3. Core Inflation Measures in Pakistan

As mentioned earlier, attempts to compute core inflation series in Pakistan are based on two widely applied statistical techniques, i.e. excluding fixed items approach and trimmed mean approach. The former technique is based on permanently excluding specific items from the basket used to compute headline inflation. The rationale is that these excluded items are subject to extreme price changes due to temporary or one-time non-monetary factors, such as seasonal supply shocks in food items. These excluded items are generally being selected on a subjective criterion. This approach is relatively easy to explain to the general public and can be applied on both group and individual item-wise price data. In Pakistan, this technique is applied on both group level and detail item-wise prices of the CPI basket to compute core inflation series. There are at least 4 such series that are based on this approach. These are either in use at present or were computed in the past. Description of these variant series is given in **Table 1**.

Table 1: Description of Core Inflation Measures in Pakistan

Series	Data used	Description	Computed by
Excluding fixed items approach			
CF	CPI group-wise	Excluding food and fuel and lightening groups	Tahir (2003); SBP and ES
CT	CPI group-wise	Excluding food and transport and communication group	SBP
CI	CPI Individual Item-wise	Excluding: food items; diesel; petrol; kerosene; CNG; and gas and electricity charges.	SBP
CVAM	CPI Individual Item-wise data	Excluding items with coefficient of variation equal to or above 250	Tahir (2003)
Trimmed mean approach			
C1010	CPI Individual Item-wise	By trimming 20 percent (10 percent each from top and bottom)	SBP
C1515	CPI Individual Item-wise	By trimming 30 percent (15 percent each from top and bottom)	SBP*
C2020	CPI Individual Item-wise	By trimming 40 percent (20 percent each from top and bottom)	SBP*
CN1010	CPI Individual Item-wise	By trimming 20 percent (10 percent each from top and bottom, and ignoring items for which prices were not available)	This paper
CN2020	CPI Individual Item-wise	By trimming 40 percent (20 percent each from top and bottom, and ignoring items for which prices were not available)	This paper

*: These are being computed but not being used by SBP

The trimmed mean approach excludes items from the headline price basket which show extreme price changes. Unlike the exclusion approach, excluded items in this approach can vary from time to time. This technique requires detail item-wise prices. In this approach various core inflation series can be computed by selecting different trimming levels. In Pakistan, only SBP is computing trimmed base core inflation series. In fact, the Bank has automated the computing process and the program can generate various series using different trimming levels. SBP is, however, analyzing and reporting inflation in 20 percent trimmed basket only (i.e. by trimming 10 percent most volatile prices from each end).

As presented in the next section, none of the existing trim-based core inflation measures were fulfilling the zero intercept condition of test 1. In fact difference of headline inflation with each of the three trimmed base series, i.e. C1010, C1515, C2020, was positive and statistically significant. This implies that these series are systematically underestimating true core inflation.

Table 2: Results of Test Applied to Various Core Inflation Measures

Core inflation measures (π^*)	Condition 1		Condition 2	Condition 3		Conclusion
	(a): (π - π^*) is stationary	α = 0, given (a) holds	Is π^* is an attractor of π (γ =0)	Is π is an attractor of π^*	Strong exogeneity ($\theta_1 = \theta_2 \ldots \theta_s$=0)*	
Excluding fixed items approach						
CF	Yes ADF = -3.02	Yes P-val = 0.22	Yes P-val = 0.00	Yes P-val = 0.08	-	Failed in condition 3
CT	Yes ADF = -3.46	Yes P-val = 0.48	Yes P-val = 0.03	Yes P-val = 0.03	-	Failed in condition 3
CI	Yes ADF = -3.23	No P-val = 0.03	Yes P-val = 0.00	No P-val = 0.37	No F(2, 157) = 0.02	Failed in condition 3
CVAM	Yes ADF = -6.58	No P-val = 0.00	No P-val = 0.22	No P-val = 0.26	No F(3, 84) = 0.01	Failed in condition 2
Trimmed mean approach						
C1010	Yes ADF = -4.47	No P-val = 0.00	Yes P-val = 0.00	No P-val = 0.18	Yes F(2, 159) = 0.26	Ok (except α = 0)
C1515	Yes ADF = -4.61	No P-val = 0.00	Yes P-val = 0.00	No P-val = 0.31	Yes F(2, 158) = 0.31	Ok (except α = 0)
C2020	Yes ADF = -4.62	No P-val = 0.00	Yes P-val = 0.00	No P-val = 0.30	Yes F(2, 159) = 0.12	Ok (except α = 0)
CN1010	No ADF = -4.40	No P-val = 0.00	Yes P-val = 0.00	No P-val = 0.16	Yes F(2, 159) = 0.27	Ok (except α = 0)
CN2020	Yes ADF = -4.64	No P-val = 0.00	Yes P-val = 0.00	No P-val = 0.44	Yes F(1, 158) = 0.12	Ok (except α = 0)

*: Given λ = 0

A possible reason could be SBP current practices of treating inflation in some seasonal items as zero, as period prices of these items are not available. An alternate treatment could be to ignore these items, in the period where data is missing, and distribute their weights on remaining items in the basket on pro rata basis. In fact, FBS is applying a similar methodology in computing headline inflation series. Using this alternate treatment and by applying trimmed based approach two new core inflation series, CN1010 and CN2020, are generated here (see **Table 1**).

4. Results

All the core inflation series described in **Table 1** are checked for the conditions proposed by Marques et al. (2000), and results are summarized in **Table 2**. Sample period for all the series are taken from July 1992 to April 2006 (for data see **Annexure 1**); except CVAM for which inflation data during July 1992 to June 2000 is used.[9]

The second column in **Table 2** shows if headline and core inflation series are co-integrated or not. Augmented-Dickey Fuller (ADF) test, with intercept, is applied on the series $(\pi_t - \pi_t^*)$ to check this condition. As headline as well as all core inflation measures are integrated of order 1, i.e. I(1) (see **Annexure 3**), to pass the co-integration test, $(\pi_t - \pi_t^*)$ should be stationary. The results suggest that all the core inflation series are co-integrated with headline inflation.

The next step was to test the second part of condition 1, i.e. to check the null hypothesis if α in equation 2 is equal to zero.[10] To test this condition, simple t-test is used and P-values are reported in the third column of **Table 2**. Only CF and CT series satisfied this condition. Constant term in case of the remaining series, except CVAM,[11] is positive and statistically significant (see **Table 3**). This shows that CI and all the trimmed based approaches, including CN1010 and CN2020, are systematically underestimating true core inflation measure.

Table 3: Values of α and Significance Level

	α	Std. error	P-value
CF	0.078	0.063	0.22
CT	0.047	0.066	0.48
CI	0.157	0.072	0.03
CVAM	-0.327	0.063	0.00
C1010	0.195	0.059	0.00
C1515	0.235	0.066	0.00
C2020	0.241	0.068	0.00
CN1010	0.149	0.052	0.00
CN2020	0.207	0.062	0.00

[9] Data for this variable is taken from Tahir (2003).
[10] This condition is test conditional on $(\pi_t - \pi_t^*)$ is stationary.
[11] The constant term in CVAM case is negative and statistically significant, showing that this measure systematically overestimates true core inflation measure.

However, values of α in case of CN1010 and CN2020 are lower than that of C1010 and C2020, respectively. In fact differences among these series are statistically significant. This suggests that underestimation by the existing trim-based core inflation measures is only partial because of SBP's current practice to consider zero inflation in some seasonal items (for periods when prices are not available).

Another possible explanation, for the fact that all the core inflation measures failed to satisfy $\alpha = 0$ condition, is that all the existing core inflation measures apply uniform trimming ratios at the bottom and top. If the distribution of price changes is not normal, rather skewed and leptokurtic, using uniform trimming ratios may not be appropriate. Tahir (2003) analyzed in detail the statistical properties of price changes in Pakistan. The study found that price distribution is positively skewed and leptokurtic. In this scenario, a trim-based core inflation measure with higher trimming from top than bottom may solve the problem of downward bias.

In order to test the second condition, i.e. if core inflation measure is an attractor of headline inflation, equation 3 is estimated for each series and t-test is applied on the co-efficient of γ. The null hypothesis was $\gamma = 0$ and rejection implies that core inflation measure is an attractor of headline inflation. P-values for the test are reported in the fourth column of **Table 2**.[12] Only CVAM series failed to fulfill this condition.

The fifth column in **Table 2** summarizes results of the first part of condition 3, i.e. whether headline inflation is an attractor of core inflation or not. This condition is checked by estimating equation 4 and testing if λ is equal to zero. Except CF and CT, all the series passed this test. Conditional on the result of first part, F-test is applied on the coefficients of lags of headline inflation in Equation 4. Results are reported in the sixth column of **Table 2**.[13] Only trimmed based core inflation series satisfy the strong exogeneity condition.[14]

Considering the overall results of tests applied, none of the series of core inflation measures in Pakistan fully satisfied all the three conditions proposed by Marques et al. (2000). However, ignoring the zero intercept condition, trimmed mean based core inflation measures performed well in passing all the conditions.

[12] To test this condition, equation 3 was estimated both with and without intercept terms. In both cases conclusion remained same. Table 2, reports the results based on estimated equation with intercept term.
[13] Conclusion remained same whether equation 4 is estimated with or without intercept term.
[14] CF series is also tested for strong exogeneity condition; the series failed in satisfying this condition as well.

5. Conclusion

While one of the most important objectives of monetary policy is to ensure price stability, the policy can not be designed to address all price changes. In particular, it is less desirable for a central bank to change its monetary stance to address temporary non-monetary supply-induced changes in inflation. Because of similar considerations, the concept of core inflation is gaining importance and many central banks have started monitoring some estimates of core inflation along with movement in headline inflation. The basic idea is to separate the transitory and permanent (core) component from headline inflation.

The concept is also getting popular in Pakistan. In fact, SBP has been reporting and analyzing core inflation measures since 2003. There is no unique way of computing core inflation and various series have been estimated in Pakistan by using two commonly used techniques, i.e., excluding fixed items approach and trimmed mean approach. However, no study has attempted to evaluate if the estimated core series is actually doing their job; i.e. whether they are truly representing the underlying (permanent) inflation or not. The objective of this study is to fill this gap.

Using the methodology proposed by Marques et al. (2000), nine alternative core inflation measures in Pakistan have been tested. The results suggest that none of the series, based on excluding fixed items approach, passed the evaluation tests. In specific terms, these are not strongly exogenous and have dual causation with headline inflation.

On the contrary, the estimated series based on trim-mean approach satisfies all the conditions to be a true estimator of core inflation. However, trimmed base series systematically underestimates true underlying inflation series, as all the series have significantly positive intercept in the ADF test applied on ($\pi_t - \pi_t^*$). For example, C1010 measure of core inflation, that SBP is presently monitoring, underestimates true core inflation by 20 basis points on average. At 95 percent confidence interval under-reporting in this measure can vary between 8 to 31 basis points.

The study tried to improve on this condition. Two new core inflation series CN1010 and CN2020 are computed by making an adjustment in the procedure currently followed by SBP. However, the new series only partially addresses the issue and fails to completely remove the underestimation problem. Thus, the analysis and decision on core inflation series should factor in this likely underestimation. Also, there is a need to develop a new core inflation measure that can

overcome this shortcoming. Given that the price distribution is skewed and leptokurtic, an asymmetric trim-mean approach could be one possible method that can help to solve the issue.

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Annexure 1: Yearly Core Inflation (Point to Point)

percent

Months	CF	CT	CI	C1010	C1515	C2020	CN1010	CN2020
Jul-92	8.6	8.6	9.0	9.9	10.2	10.5	10.1	10.6
Aug-92	8.4	8.4	8.8	10.1	10.3	10.4	10.3	10.6
Sep-92	8.2	8.3	8.6	9.6	9.7	10.0	9.8	10.1
Oct-92	8.0	8.2	8.6	9.4	9.5	9.8	9.5	9.9
Nov-92	8.0	8.2	8.5	9.1	9.3	9.5	9.3	9.7
Dec-92	7.8	8.2	8.4	8.9	9.0	9.3	9.1	9.6
Jan-93	8.0	8.3	8.7	8.9	9.0	9.2	8.8	9.1
Feb-93	8.3	8.4	8.9	8.5	8.5	8.8	8.7	9.0
Mar-93	8.3	8.3	8.8	8.2	8.2	8.4	8.5	8.6
Apr-93	8.3	8.3	8.7	8.3	8.2	8.4	8.5	8.5
May-93	8.2	8.2	8.6	8.4	8.5	8.6	8.6	8.8
Jun-93	8.4	8.1	8.5	8.3	8.4	8.7	8.4	8.8
Jul-93	9.2	9.1	9.4	8.9	9.0	9.2	9.0	9.3
Aug-93	9.7	10.9	9.5	9.4	9.5	9.7	9.5	9.9
Sep-93	10.3	11.2	10.1	9.9	9.9	10.0	10.1	10.2
Oct-93	11.2	11.7	11.0	10.5	10.4	10.3	10.7	10.4
Nov-93	11.3	11.7	11.1	10.5	10.3	10.2	10.7	10.4
Dec-93	11.5	11.9	11.2	10.1	10.1	10.0	10.4	10.2
Jan-94	11.4	11.7	11.1	9.8	9.7	9.7	10.1	9.9
Feb-94	11.0	11.5	10.7	9.9	9.9	9.9	10.2	10.1
Mar-94	10.9	11.4	10.6	10.0	9.9	9.9	10.3	10.2
Apr-94	11.2	11.6	10.9	11.9	11.8	11.6	12.2	11.8
May-94	11.6	11.9	11.3	11.3	11.2	11.0	11.5	11.2
Jun-94	11.3	11.8	11.2	11.4	11.2	11.0	11.6	11.1
Jul-94	10.9	11.2	10.7	11.4	11.1	10.8	11.6	11.0
Aug-94	10.3	9.3	10.5	10.4	10.1	10.1	10.6	10.2
Sep-94	9.9	9.2	10.0	10.5	10.2	10.0	10.7	10.2
Oct-94	9.3	8.9	9.3	10.9	10.6	10.5	11.1	10.6
Nov-94	9.2	8.9	9.4	11.3	11.0	10.8	11.5	11.0
Dec-94	9.1	9.3	9.4	11.9	11.5	11.2	12.2	11.4
Jan-95	9.3	9.5	9.7	12.2	11.9	11.5	12.5	11.7
Feb-95	9.5	9.7	9.9	11.4	11.2	10.9	11.8	11.2
Mar-95	9.5	9.7	9.9	11.7	11.5	11.3	12.0	11.5
Apr-95	9.6	9.9	9.9	9.5	9.4	9.4	9.7	9.6
May-95	9.8	10.0	10.0	10.2	10.1	10.1	10.4	10.2
Jun-95	9.7	10.2	9.9	9.7	9.7	9.8	9.8	9.9
Jul-95	9.7	11.1	9.8	9.7	9.6	9.7	9.8	9.9
Aug-95	10.1	11.4	10.1	10.9	10.7	10.7	11.1	10.9
Sep-95	10.5	11.9	10.5	10.8	10.7	10.7	11.0	10.9
Oct-95	10.6	11.8	10.2	10.1	10.2	10.4	10.3	10.6
Nov-95	10.8	12.0	10.4	9.4	9.5	9.7	9.6	9.9
Dec-95	11.3	12.1	10.9	9.4	9.5	9.7	9.7	10.0
Jan-96	11.7	11.9	11.2	9.5	9.5	9.8	9.8	10.1
Feb-96	11.5	11.7	11.0	9.9	9.9	10.2	10.1	10.5
Mar-96	11.6	11.7	11.2	9.9	9.9	10.0	10.2	10.3
Apr-96	11.6	11.7	11.3	10.2	10.3	10.3	10.5	10.5

Months	CF	CT	CI	C1010	C1515	C2020	CN1010	CN2020
May-96	11.6	11.5	11.3	10.4	10.4	10.3	10.6	10.5
Jun-96	11.6	11.4	11.3	10.0	10.0	9.9	10.3	10.1
Jul-96	11.4	10.2	11.3	9.9	9.9	9.8	10.0	9.9
Aug-96	11.7	10.5	11.7	9.7	9.7	9.6	9.9	9.8
Sep-96	11.5	10.2	11.4	9.8	9.9	9.8	10.0	9.9
Oct-96	11.7	10.8	11.7	10.5	10.4	10.3	10.7	10.4
Nov-96	12.0	11.3	11.8	10.9	11.0	10.9	11.2	11.0
Dec-96	12.1	11.4	12.0	11.1	11.1	11.1	11.4	11.2
Jan-97	11.9	12.0	11.9	12.9	12.5	12.0	13.2	12.2
Feb-97	11.8	11.9	11.9	13.3	12.8	12.5	13.5	12.7
Mar-97	12.1	12.2	11.9	11.6	11.3	11.0	11.9	11.2
Apr-97	11.7	11.9	11.8	11.8	11.2	11.0	12.1	11.2
May-97	10.9	11.8	11.0	11.9	11.5	11.3	12.1	11.4
Jun-97	10.8	11.6	10.8	11.6	11.2	11.1	11.8	11.2
Jul-97	10.3	11.2	10.3	10.8	10.5	10.4	11.1	10.5
Aug-97	9.5	10.4	9.4	9.6	9.3	9.2	9.8	9.4
Sep-97	9.0	10.0	9.1	9.3	9.0	9.0	9.6	9.2
Oct-97	8.3	9.1	8.3	8.5	8.2	8.2	8.6	8.3
Nov-97	7.8	8.2	8.0	8.4	7.9	7.8	8.6	8.0
Dec-97	6.8	7.2	7.1	7.5	7.1	7.1	7.8	7.3
Jan-98	6.0	6.2	6.1	5.8	5.7	5.9	6.0	6.1
Feb-98	5.8	6.0	5.7	5.5	5.5	5.7	5.7	5.9
Mar-98	5.2	7.9	5.4	5.9	5.7	5.8	6.1	6.0
Apr-98	5.3	8.0	5.2	4.4	4.6	4.8	4.5	5.0
May-98	5.6	7.7	5.4	4.9	5.0	5.1	5.0	5.3
Jun-98	5.5	7.6	5.4	5.2	5.2	5.4	5.3	5.5
Jul-98	6.0	7.7	5.5	5.7	5.5	5.6	5.9	5.7
Aug-98	6.0	7.5	5.6	5.8	5.6	5.6	6.0	5.8
Sep-98	5.9	7.4	5.4	5.4	5.3	5.4	5.5	5.6
Oct-98	6.0	7.5	5.3	5.2	5.1	5.2	5.3	5.3
Nov-98	5.6	4.9	5.0	4.7	4.8	4.8	4.8	4.9
Dec-98	6.0	5.3	5.3	4.8	4.8	4.9	5.0	5.1
Jan-99	6.2	5.5	5.5	5.1	5.0	5.1	5.2	5.3
Feb-99	6.4	5.7	5.8	5.0	4.9	5.0	5.2	5.2
Mar-99	6.4	3.3	5.9	5.0	4.9	5.0	5.2	5.2
Apr-99	6.5	3.2	6.0	5.1	5.0	5.0	5.2	5.1
May-99	6.4	3.0	5.6	4.9	4.8	4.9	5.0	5.0
Jun-99	6.2	2.8	5.4	4.2	4.0	4.0	4.3	4.0
Jul-99	5.6	2.6	5.2	3.7	3.5	3.4	3.8	3.5
Aug-99	5.4	2.6	5.0	3.7	3.6	3.5	3.8	3.6
Sep-99	5.4	2.9	5.2	4.4	4.3	4.2	4.4	4.3
Oct-99	5.3	4.2	5.2	4.5	4.4	4.2	4.6	4.2
Nov-99	5.3	6.4	5.0	4.4	4.2	4.0	4.5	4.1
Dec-99	5.0	6.0	4.5	3.7	3.5	3.4	3.8	3.5
Jan-00	4.8	5.8	4.3	3.6	3.4	3.2	3.7	3.4
Feb-00	4.5	5.6	4.0	3.7	3.5	3.4	3.8	3.5
Mar-00	4.4	5.3	3.9	3.8	3.4	3.2	3.9	3.4
Apr-00	4.5	5.1	4.0	4.0	3.6	3.4	4.2	3.6
May-00	4.4	4.8	4.2	3.9	3.7	3.4	4.0	3.5

Months	CF	CT	CI	C1010	C1515	C2020	CN1010	CN2020
Jun-00	4.1	4.5	4.1	4.1	3.7	3.3	4.3	3.6
Jul-00	4.3	5.1	4.0	4.3	3.9	3.5	4.4	3.7
Aug-00	4.6	5.3	4.2	3.9	3.6	3.3	4.0	3.5
Sep-00	4.6	5.6	4.2	4.2	3.8	3.5	4.3	3.7
Oct-00	4.4	4.2	4.0	3.7	3.4	3.1	3.8	3.3
Nov-00	4.4	4.1	4.1	3.6	3.3	3.1	3.8	3.3
Dec-00	4.3	4.3	4.0	3.6	3.3	3.1	3.8	3.3
Jan-01	4.3	4.2	3.9	3.7	3.4	3.2	3.8	3.4
Feb-01	4.2	4.0	3.8	3.9	3.5	3.2	4.1	3.4
Mar-01	3.8	3.9	3.6	3.6	3.2	2.9	3.7	3.1
Apr-01	3.8	3.9	3.5	3.4	3.1	2.9	3.5	3.1
May-01	3.6	4.7	3.4	2.8	2.4	2.2	2.8	2.3
Jun-01	4.2	5.1	3.4	2.2	2.1	2.0	2.3	2.2
Jul-01	4.4	4.8	2.9	1.8	1.8	1.9	1.9	1.9
Aug-01	4.2	4.7	2.7	2.3	2.1	2.1	2.5	2.1
Sep-01	3.9	3.9	2.4	1.9	1.8	1.9	2.4	2.0
Oct-01	3.5	3.6	2.2	1.8	1.7	1.6	2.4	2.0
Nov-01	2.8	3.2	2.0	1.9	1.8	1.7	2.5	2.1
Dec-01	3.0	3.4	2.0	1.6	1.6	1.6	2.2	2.1
Jan-02	3.1	3.7	2.0	1.9	1.8	1.7	2.4	2.1
Feb-02	3.3	3.7	2.1	2.1	2.0	1.9	2.1	2.0
Mar-02	3.2	3.9	1.9	2.2	2.0	1.9	2.2	2.0
Apr-02	2.9	4.2	1.6	2.0	1.9	1.8	2.0	1.8
May-02	3.8	4.2	2.0	1.9	1.6	1.5	2.0	1.5
Jun-02	3.8	4.5	1.9	2.3	2.0	1.8	2.4	1.9
Jul-02	2.2	2.8	2.7	2.7	2.4	2.2	2.8	2.2
Aug-02	2.2	2.9	2.5	2.4	2.2	2.0	2.5	2.0
Sep-02	2.1	2.9	2.4	2.4	2.3	2.1	2.5	2.2
Oct-02	2.5	2.8	2.1	2.4	2.3	2.0	2.5	2.1
Nov-02	2.5	3.2	2.5	2.3	2.1	1.9	2.4	1.9
Dec-02	3.1	3.5	2.7	2.5	2.4	2.1	2.5	2.2
Jan-03	3.2	3.4	2.6	2.4	2.3	2.0	2.4	2.1
Feb-03	3.4	3.3	3.2	1.9	2.1	1.9	2.4	2.1
Mar-03	3.3	2.9	3.3	1.4	1.7	1.8	1.9	2.0
Apr-03	2.8	2.7	4.0	1.8	1.9	1.8	2.2	2.1
May-03	2.2	2.9	3.3	1.7	2.0	2.2	2.2	2.4
Jun-03	2.3	2.7	3.2	1.1	1.5	1.8	1.6	2.0
Jul-03	2.4	2.8	3.2	1.9	2.0	1.9	2.2	2.1
Aug-03	2.5	2.8	3.4	2.1	2.2	2.1	2.4	2.3
Sep-03	2.6	3.0	3.6	2.4	2.4	2.3	2.7	2.5
Oct-03	2.7	3.1	3.0	2.7	2.5	2.4	3.0	2.6
Nov-03	3.5	3.2	3.2	3.6	3.3	3.1	3.8	3.3
Dec-03	3.2	3.1	3.3	4.0	3.4	3.4	4.2	3.5
Jan-04	3.5	3.4	3.7	3.8	3.5	3.4	4.4	4.0
Feb-04	3.4	3.7	4.0	3.8	3.5	3.5	4.0	3.6
Mar-04	4.0	4.2	4.3	4.7	4.4	4.4	5.0	4.6
Apr-04	5.2	4.7	4.4	5.6	5.3	5.3	5.7	5.4
May-04	5.7	4.7	5.2	6.4	5.8	5.8	6.5	5.9
Jun-04	5.8	5.0	5.7	7.2	6.6	6.5	7.3	6.6

Months	CF	CT	CI	C1010	C1515	C2020	CN1010	CN2020
Jul-04	6.1	5.4	5.8	7.6	7.0	7.0	7.6	7.2
Aug-04	6.4	5.7	6.1	8.0	7.6	7.7	8.1	7.8
Sep-04	6.8	6.2	6.4	7.9	7.5	7.6	8.0	7.8
Oct-04	6.9	6.4	6.7	7.8	7.7	7.9	7.9	8.0
Nov-04	7.0	6.6	6.9	8.1	8.1	8.4	8.3	8.6
Dec-04	7.6	7.0	7.1	7.7	7.9	8.2	7.8	8.4
Jan-05	7.9	7.2	7.3	8.3	8.4	8.8	7.9	8.2
Feb-05	8.3	7.8	7.4	8.6	8.5	8.7	8.7	9.0
Mar-05	8.5	7.8	7.6	8.0	7.9	7.9	8.2	8.3
Apr-05	8.4	7.5	7.9	8.5	8.5	8.8	8.6	9.0
May-05	8.5	7.5	7.5	8.0	8.0	8.1	8.2	8.4
Jun-05	8.9	7.6	7.4	7.7	7.8	7.9	7.8	8.0
Jul-05	8.9	7.7	7.6	7.3	7.3	7.4	7.4	7.6
Aug-05	9.2	7.7	7.6	7.1	7.1	7.2	7.2	7.4
Sep-05	9.6	7.6	7.6	7.0	7.1	7.2	7.1	7.3
Oct-05	9.9	7.7	7.8	7.0	7.1	7.1	7.1	7.2
Nov-05	9.7	7.5	7.6	6.8	6.8	6.9	6.9	7.0
Dec-05	9.1	7.2	7.4	6.5	6.5	6.5	6.6	6.6
Jan-06	8.7	7.8	7.3	6.5	6.4	6.4	6.6	6.5
Feb-06	8.2	7.3	7.0	6.4	6.3	6.2	6.5	6.4
Mar-06	7.8	7.0	6.7	6.1	5.9	5.8	6.2	5.9
Apr-06	7.6	7.2	6.4	6.0	5.9	5.9	6.1	5.6
Mean	7.1	7.1	6.8	6.7	6.6	6.6	6.9	6.7
Standard deviation	3.0	3.1	3.1	3.3	3.3	3.4	3.3	3.4
Coefficient of variation	0.5	0.4	0.4	0.5	0.5	0.5	0.5	0.5

Note: (a) For data of CVAM see Tahir (2003)

(b) Estimates: Jul 92 to Jan 02 are based on old basket of 1990-91; Jul 02 to Apr 06 are based on new basket of 2000-01; Feb 02 to Jun 02 are based on overlapping items in old and new baskets (representing 93.2 percent of new basket).

Annexure 2: Performance of Core Inflation Measures in Desirable Properties

	CF	CT	CI	CPIVAM	Trimmed mean
Computable in real time	Yes	Yes	Yes	Yes	Yes
Verifiable	Yes	Yes	Yes	Yes	Yes
Track record	Yes	Yes	Yes	Yes	Yes
Understandable by general public	Yes	Yes	Yes	May be	May be
History does not change	Yes	Yes	Yes	Yes	Yes
Forward looking	No	No	No	No	No
Theoretical basis	No	No	No	No	No

Annexure : Results of Stationarity Tests

	Test on Level		Test on First Difference	
	ADF test statistics	**Prob.**	**ADF test statistics**	**Prob.**
CPI inflation	-1.10	0.71	-5.21	0.00
CF	-1.26	0.65	-8.09	0.00
CT	-1.46	0.55	-10.37	0.00
CI	-1.27	0.64	-5.42	0.00
CVAM	-0.69	0.84	-8.90	0.00
C1010	-1.25	0.65	-11.46	0.00
C1515	-1.24	0.66	-11.47	0.00
C2020	-1.25	0.65	-11.41	0.00
CN1010	-1.25	0.65	-11.71	0.00
CN2020	-1.22	0.66	-7.00	0.00

Note: P-values are based on *MacKinnon (1996) one-sided p-values.