Some Measures of Core Inflation and Their Evaluations in Nepal

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This paper measures core inflation and evaluates their performance in Nepal. Concept of core inflation and survey of methodologies as well as international experiences and empirical evidence have been reviewed and analysed before measuring the core inflation in Nepal. An existence of asymmetric price distribution necessitates the alternative measure of inflation in place of traditional CPI-based headline inflation. Ultimately, by using exclusion method and stochastic measures, nine different types of core inflations have been computed. Empirical results show that core inflations perform better than the headline inflation in several aspects such as having less volatility, highly relating to money supply growth, and capturing the permanent component of headline inflation. Better core inflation is selected with the help of different performance criteria such as observing statistical properties, tracking trend inflation, finding the relationship with money supply, and the analysing the ability of capturing permanent component and forecasting capacity. However, no single core measure performs better in all aspects. Hence, a set of core inflation measures, namely exclusion based, weighted median and trimmed mean should be analysed in conducting the monetary policy in Nepal.

I. INTRODUCTION

A conduct of monetary policy requires the information on inflation, among others. The relationship between monetary policy and inflation can be traced out from the classical quantity theory of money i.e. the famous Fisherian equation[1]. Past experiences and empirical studies in the world also suggest that high inflation distorts the decision of private sector on investment, saving and production, which ultimately lead to slower economic growth (Barrow, 1995). As such, price stability has been considered as a main objective of monetary policy during the recent years and a most important yardstick to

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[1] MV = PY, where, M = money stock, V = velocity of circulation, P = general price and Y = output

measure the success of monetary policy. Taking a sole objective of price stability, a growing number of countries have been adopting the inflation-targeting regime[2] to achieve this goal and have succeeded in achieving it to the larger extent (Duebelle, 1998 and Waiquamdee, 2001).

There are several methods of measuring inflation in the economy, for example, GDP deflator, Wholesale price index (WPI), Consumer Price Index (CPI) and so on. Among others, a widely used and easily understood measurement of inflation is the CPI-based inflation. In fact, the CPI measures the cost of living index of people and it is constructed by collecting the prices of goods and services included in the consumption basket, assigning the appropriate weight to each items based on the expenditure pattern of people. Many countries calculate inflation figure based on the change in CPI as; $(\pi) = CPI_t\text{-}CPI_{t-1}/CPI_{t-1}$. However, the consumption basket differs from one country to the other.

Though CPI-based inflation is commonly used, it tends to have noises, being influenced by the transient shocks. Inflation may result due to cost-push or demand-pull factors in the economy. Hence, the conduct of the monetary policy on the basis of the inflation information from the CPI may distort the final outcome of it. As a result, to make monetary policy accountable and credible, there should be the alternative measures of inflation by eliminating the supply shocks and transitory shocks from the CPI inflation. Such measures are termed as "core inflation" or "underlying inflation". They would serve as a way to monitor progress of monetary policy towards the goal of price stability.

In Nepal, as per the Nepal Rastra Bank (NRB) Act 2002, the main objectives of monetary policy also incorporate the price stability in addition to balance of payments consolidation. To keep the accountability and credibity of monetary policy towards the objective of price stability, NRB also needs to focus on the computation and analysis of core inflation because various studies (Khatiwada, 1994; NRB, 2001, Pandey, 2005) have revealed that inflation in Nepal is highly influenced by the supply shocks, existing Indian prices and the government administered price. For example, very recently (particulary since the mid-half of 2004/05), after witnessing consecutive low inflation for couples of years, the upward trend in CPI based inflation has been observed due mainly to hike in petroleum prices and VAT rate by the government as well as rise in food price because of bad weather.

In fact, the conventional measurement of price changes by computing CPI does not provide with adequate insight into the differential impact of demand and supply influences on the measured inflation rate. Thus, the identification of sources of inflationary pressure is essential for the formulation of appropriate monetary policy responses. This has necessitated to find the way for the refinement of the measurement of inflation for which the concept of estimating core inflation by eliminating transitory noises or distortionary effects of supply shocks has come up in widespread uses.

On this backdrop, this paper is the extension and updated version of the paper published earlier (Shrestha, 2002) expanding the coverage of the subject matter and

[2] Inflation targeting framework evolved in 1990s after the failure of both the money-growth targeting framework in the developed countries and the exchange rate targeting framework in the emerging economies. In this framework, inflation target is taken as both final goals and intermediate goals. Any deviation of forecast of inflation from inflation target demands the change in monetary instruments.

sample period. There has not been any other attempts made to measure core inflation in the Nepalese context, though some interest has been shown on the matter of core inflation recently by NRB, particularly to defend the monetary policy from rising inflation. Hence, this paper has again attempted to compute core inflation measures extending the coverage till 2004/05 in Nepal to identify the best measures of core inflation which extracts the generalized and persistent part of CPI[3] price change in Nepal.

This paper is organized as follows. First of all, this paper highlights the concept of core inflation and its uses in the second section followed by the methodological discussion in the section third. The section four will examine international experience and empirical evidence related to measuring core inflation. Then, data coverage and methodology applied in this paper are discussed in the section five. The section six will analyse the nature of distribution of price change in Nepal, followed by the empirical measures of core inflation in the section seven. The section eight evaluates the performance of different core measures. Finally, the discussion will be concluded in the section nine.

II. Core Inflation: Concept and Its Uses

Inflation is generally defined as a persistent rise in price in the economy. However, price change is measured commonly by the weighted arithmetic mean (Laspeyers index), among others. It is argued that this conventional price measure does not distinguish the differential impact of demand and supply shocks because it includes both the inflation generated by demand-pull and cost-push factors. Therefore, the concept of core inflation emerged as an inflation, which is directly related to the demand factors.

The term core inflation has widespread used but it appears to have no clear definition though early attempts to define core inflation can be found in Eckstein (1981) and Blinder (1982) (cited in Bryan and Cecchetti, 1993). As mentioned in Rich and Steindel (2005), the more familiar core inflation measures as aggregate price growth excluding food and energy appears to have first been analysed in a systematic fashion in a 1975 paper by Robert Gordon.

In the economic literature, however, there are six broad concepts of core inflation. The first definition is of Eckstein (1981) which defines the core inflation as an inflation that is related to the concept of output neutral inflation. Quay and Vahey (1995) also define the core inflation in line with Eckstein. The second concept defines core inflation as an expected inflation from different price index series, while the third one considers core inflation as the persistent component of measured inflation. The fourth assumes that price changes in any individual commodity consist of two components -a common trend and a relative price shock- and core inflation tries to estimate the common trend. The fifth one identifies a list of commodities which are likely to be prone to supply shocks (outside the preview of monetary policy) and compiles the price index by excluding these commodities from the basket with a view to capturing the demand related (or core)

[3] Some may argue for taking WPI or GDP deflator for measuring core inflation. However, since the ultimate concern of the monetary policy is the welfare maximization of final consumers, it is most relevant for monetary policy to focus on the CPI, and core inflation measures should be based on the CPI (Tahir, 2003).

inflation (Samanta, 1999). Lastly, Bryan and Ceccetti (1993) define the core inflation as a money-induced inflation, which is expected to persist over medium-run horizons of several years, in which core inflation (πc) = money growth.

In the mathematical equation form, as per the second concept, actual inflation is represented by (Roger, 1998)

$$\Pi_t = \pi_t^e + g(X_t) + V_t$$

where,

Π_t = aggregate inflation rate in period 't'

π_t^e = expected inflation

$g(X_t)$ = measure of excess demand pressure

V_t = measure of supply disturbance

Then, core inflation Π_c is,

$\Pi_c = \Pi_t - g(X_t) - V_t = \pi_t^e$ = the expected inflation rate

while non-core inflation, Π_{nc} , is

$\Pi_{nct} = g(X_t) + V_t$

As per the third and fourth concept, the observed price change Π_t is (Wynne, 1999)

$\Pi_t = \pi_t + X_t$

This expression defines the rate of change of the price of an individual commodity $\Pi_t = \ln(P_t) - \ln(P_{t-1})$, as consisting of an aggregate inflation component (persistent) π_t and a transient price change component X_t. The objective of core inflation is to find out π_t - the persistent component of all prices.

As per the fifth concept, the conventional measured inflation is

$\Pi_t = \Pi_d + \Pi_s$

where,

Π_d = inflation generated by demand factor

Π_s = supply shocked inflation.

Core inflation takes 'Π_d' under consideration by excluding supply- affected inflation.

Though many define the core inflation differently, but monetary policy operation should consider the core inflation as the one which is highly influenced by demand side rather than supply side. Moreover, that should be the core inflation which excludes the temporary influences on inflation due to one-off shift in the price level resulting from a change in tax rate or due to extreme change in weather conditions, or rise in international oil price due to political crisis.

With regard to uses of core inflation, many central banks, in recent years, have highlighted the measures of core inflation in the course of policy formulation and communication. Although the concept of core inflation emerged in the 1970's, a renewed interest has emerged in the 1990's, because of its importance especially with the introduction of inflation targeting regime in many countries. While the headline inflation is often volatile and unreliable predictor of the true inflationary trend, core inflation can be a more accurate measure of underlying inflation and can be a useful weapon in the quest for price stability. Even countries that do not explicitly adopt inflation targeting as a policy regime often publish their measures of core inflation and use them as monitoring tool such as USA and Pakistan.

It is a well-established fact that monetary policy affects the price after a long lag. As such, monetary policy responses to CPI based inflation may be inappropriate, because of containing relative price shocks. Non-monetary events such as sector-specific shocks and the government policy can temporarily produce noise in the price data that substantially affects the aggregate price indices. The core inflation attempts to extract the persistent part of the headline inflation, useful to make monetary policy decision. A rationale for focusing on core inflation is that there is a significant amount of transient noise in the movement of aggregate CPI. Temporary shocks, despite impacting the headline index, can reverse. Therefore it does not demand a policy response from the monetary authority. In the event of supply disturbances, policy actions to counter the impact on the aggregate price level will lead to accentuate the output effects of the disturbance (Roger, 1998). Hence, a primary use of core inflation is to find a measure that is highly correlated with money growth (Bryan and Ceccheti, 1993).

An appropriate measure of inflation is essential for taking monetary policy decisions since the price stability is the main objective of monetary policy and the money supply is the most important determinant of inflation. Moreover, Marianne (1999) argues that core inflation would be (a) a good indicator of current and future trend in inflation, (b) a good measure of inflation for empirical work and (c) the most importantly, a viable target for monetary policy, very essential particularly in inflation targeting regime. Core inflation measures assist the monetary authority to separate the noise and the short-run fluctuations in the data from its more persistent trend. Moreover, core inflation can be useful to make *ex post* assessment of the effectiveness of monetary policy and helpful to maintain its accountability and credibility in public. Further, core inflation would aid in the communication or transparency of monetary policy to the public. In similar line, Roger (1998) mentions that a measure of core inflation has three distinct uses for monetary policy purpose: setting or formulation of policy, providing policy accountability, and in econometric estimation and forecasting.

In Nepal, a priori rational for the use of core inflation emerges from the inflation experience. During the period of 1996/97 to 2004/05, inflation (y-o-y) rose as high as 14.55 percent in mid-November 1998 while as low as 0.45 percent in mid-July 2000. Such a peak and tough of inflation movement was due to rise and fall of price of certain goods, mainly agricultural products. For example, in the month of mid-November 1998, the prices of vegetable increased by 66 percent, the price of oil and ghee increased by 46.0 percent, and the price of rice and rice products increased by 10.78 percent over the previous year. Contrary, in mid-July 2000, the prices of these goods declined by 12.65 percent, 15.22 percent and 13.27 percent respectively. Recently also, particularly after the second half of 2004/05, inflation experienced a rising trend due mainly to hike in VAT rate and the prices of petroleum products. An unfavourable weather conditions, resulting in supply shock in paddy production, further aggravated the inflationary situation. In this context, monetary policy should respond cautiously otherwise it can be counter productive. Hence, the use of core inflation cannot be ruled out in Nepal as in other countries.

III. METHODOLOGICAL DISCUSSION

Though there is a widespread consensus that monetary policy should focus on underlying inflation, there is no unique way of measuring underlying inflation similar to its definition. It is not a variable that can be observed directly, but it has to be estimated (Landau, 2000). In the literature, there are broadly following methods found[4].

(a) Core inflation as expectation (Jefferies, 1990),
(b) Univariate methods – moving average technique, Hodrick-Prescott (HP) filter, and Kalman filter
(c) Multivariate method-Structural Vector Auto-Regression (SVAR) framework (Quah and Vahey, 1995),
(d) Stochastic measures – mean, weighted median and trimmed mean, also called limited influence estimator
(e) Exclusion based measures

An ideal measure of core inflation should be efficient in distinguishing between persistent and transient movement in inflation. It should be unbiased to the headline inflation, otherwise it undermines credibility in providing public accountability for inflation performance. It is also important that the estimates of core inflation to be as robust as possible on different factors: sample size as well as variables used. Timely availability of core inflation estimates helps initiate corrective policy measures in time. Core inflation measure should be easily understood and readily verifiable (see Roger 1998). However, each method has their own pros and cons.

Jefferis (1990) argues that the expected inflation, based on different models and time series can track a common trend which can be considered as a core inflation. For the implementation of the *Jefferis's (1990) expectation based core inflation*, it is necessary to build up forecasting models. Subjectivity is involved in the choice of forecasting models, as such the accountability and variability of core inflation are practically lost. The model specification and estimated parameters may also vary over time depending upon both the number of observations and the time structure of data. This method lacks the timeliness and robustness of the estimated core measures.

The univariate method is based on the smoothing or filtering techniques. This process tends to eliminate the unwanted component from measured inflation. A popular and simple way is to apply the moving average technique and Hodrick-Prescott (HP) filter. A more sophisticated smoothing technique involves the use of fixed or moving seasonal adjustment factors and Kalman filters. The use of moving averages for inflation does tend to reduce the volatility of the resultant series, and may better reflect the persistent element of inflation. But, it also reduces the timeliness of information on core inflation, since the averaged series will be dominated by past rather than current inflation (Roger, 1998).

Quah and vahey (1995) suggested estimation of core inflation in a SVAR framework which decomposed the measured inflation into two uncorrelated components: core inflation and an unwanted component (noise). *The SVAR-based multivariate method* is appealing from a policy perspective because it attempts to estimate the output neutral component of measured inflation similar to the definition of Eckstein (1981). Samanta (1999) argues that a serious drawback of this technique is that it considers only two variables viz. price and output in the SVAR model. In absence of other related variables such as money, interest rates etc, the reliability and credibility of the estimates is under

[4] See Samanta (1999) for a detail discussion of methodologies of core inflation and Roger (1998).

questionable. Application of this method in the developing countries is hindred by the lack of availability of related data in a higher frequency.

Several recent studies (Bryan and Ceccheti, 1993, Roger 1998) have argued in favour of *stochastic measures viz. trimmed mean, weighted median,* etc of the cross sectional distribution of price changes as a measure of core inflation to be more efficient. These methods are also called *Limited Influence Estimators*. It is observed that sample cross sectional distribution of price changes is generally positively skewed and highly kurtotic (Roger 1998, Bryan and Cecchetti, 1993). In that case, the sample mean (weighted) i.e. $\Sigma w_i \pi_i$ (w_i =weight, π_i =price index) is inferior to some other statistics like median[5], and trimmed mean[6] for measuring the underlying inflation.

The trimmed mean involves taking a weighted average of a subset of the CPI by trimming the most extreme movement in inflation. In this case, a prior judgement for the choice of exclusion of items is not necessary, but a decision is to be made about the level of trim to cut the tails of the cross-sectional price distribution. As the sample distribution of price change may undergo a change over time, the associated optimal level of trimming may not be robust and the need for new calculation of this optimal level at every time makes the measure lose its credibility (see Samanta 1999). For trimming process, highly disaggregated level of price index data should be available so that trimming can be applied at a higher precision.

In practice, many central banks use some sorts of exclusion-based measures of core inflation based on systematically excluding prices of some items. This type of measure is timely, simple to understand, easy to verify and comparatively robust. In this method, core inflation is measured by modifying the normal expenditure based weighting system in the CPI. In this case, the existing index is reweighed by placing zero weights on some components which are excluded, and the remaining weights are rescaled.

General CPI is computed as:

$$CPIn = \Sigma_{i=1}^{n} w_{i0} P_{it}/P_{i0} *100$$

Then, the exclusion based core inflation is computed as:

$$CORE_{it} = \frac{\sum_{i-1}^{m} w_{i0} \frac{P_{it}}{P_{i0}} \times 100}{\sum_{i=1}^{m} w_{i0}} \quad \text{Where } m <= n$$

Generally, many central banks exclude food and energy[7] prices from the CPI basket. Some also exclude indirect taxes[8], administered prices[9] and interest charges[10].However, temporary disturbances are not necessarily limited to specific sub-components. A prior judgement needs to be made regarding the exclusion of certain components of CPI. It

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[5] Median item in the cross sectional distribution of price change.

[6] The α % trimmed mean inflation rate is defined as

$$IT(\alpha) = \frac{1 \Sigma W_i \pi_1}{1 - 2\alpha / 100} \text{ where, } W_i = \text{weight, } \pi_i = \text{price index}$$

[7] Generally influenced by supply shocks, impacted by weather conditions.

[8] Infrequent, once-and-for-all canges have no long run effects on inflation.

[9] Possible conflicts between monetary and fiscal policy.

[10] Perverse response- prices of these items rise when monetary policy tightened.

may be that price changes in certain items could be more volatile but completely removing these items from the price distribution over medium to long term horizon has the potential risk of permanent loss of significant signals. These sort of problems are likely to arise when the economy is undergoing significant structural changes (Roger, 1998). In contrast, the trimmed mean estimates do not exclude any component a priori, instead they systematically determine those components to exclude at each point of time based on information of relative price variability . In addition, as mentioned in Mahanty, D et.al (2000) exclusion principle for core inflation would be inadequate for developing countries because of (a) a large array of commodities show relative price volatility over time and hence it would not be appropriate to move them all from the core measure; (b) due to structural transformation, the basket of volatile commodities keeps shifting over time; the exclusion of certain items on a permanent basis may render the inflation measure less efficient; and (c) primary commodities have a strong influence on the underlying inflation as they form sizeable part of household consumption basket and therefore are crucial in the formation of price expectation.

Each method has own merits and demerits. As a result, many central banks and other researchers have computed core inflations by applying more than one methods, in addition to the exclusion based method.

IV. INTERNATIONAL EXPERIENCES AND EMPIRICAL EVIDENCE

This section reviews the existing practice of computing core inflation in a number of countries. In Australia, the Federal Treasury constructed a measure of core inflation by excluding components of inflation based on a wider set of criteria; the excluded components represents more than 40 percent of the consumption basket (Cockerel, 1999). In addition, the Reserve Bank of Australia computed other alternative core inflations for monetary policy purposes such as weighted median and trimmed core inflation.

In Canada, the Bank of Canada, a pioneer bank in computing core inflation, officially corresponds to the 12-month change in the CPI excluding food and energy, and the effects of indirect taxes, denoted by CPI*FET. It has also been taken as the operational target for policy purpose (Johnson, 1999). In addition, other alternative measures such trimming, weighted median, are also used to calculate alternative core inflations to supplement the official measure.

Appendix 1 shows a further cursory look in the international practices of measuring core inflation. A majority of countries have been adopting some sorts of exclusion, but no uniqueness in the methods adopted for exclusion. Very few countries officially use the other alternative methods of measuring core inflation. Hence, it can be argued that method of measuring core inflation is country specified, influenced by the nature of goods in consumer baskets, features of price distribution, stage of development and structure of the economy.

Regarding the empirical evidence, there are no unique way of measuring core inflation. Hence, different authors have tried to compute a set of core inflation measures and identified the best measures among them, which varies from the country to country. Some empirical researches are reviewed here.

Bryan and Cecchetti (1993) investigated the use of exclusion based and the limited-influence estimators like the 15-percent trimmed mean, and the median in the USA's CPI

data. They found that the median of the cross-sectional distribution of inflation which has the strongest relationship with past money growth and provides the most accurate forecast of future inflation, can be as a superior measure of core inflation. However, Tahir (2003), in Pakistan, found that trim-based measure compares favourably with those based on methods of excluding fixed items from the basket of CPI.

Marcos and Figueiredo (2001) also evaluated the performance of five alternative measures of core inflation such as exclusion, symmetric trimmed mean, symmetric trimmed mean with smoothed series, weighted median and double weighted indicator in Brazilian data and found that the double weighted measures and the 20% trimmed with smoothed series performed better. Moreover, in Turkey, Berkmen (2002) found that the trimmed means provide statistically more efficient estimators of inflation and the optimal trim is found to be 19 percent from each tail of the cross sectional distribution of price.

Similarly, Bryan and Cecchetti (1999), in Japan's data found that trimming the tails of the price-change distribution substantially improves high-frequency estimates of Japanese core inflation. They found that trimming approximately 35% from each tail of the price change distribution produces the most efficient monthly estimator over the full 27-year period. It seems to be a very high trimming ratio. Further, a range of trimmed-mean estimators (between 21% and the median price change) also provide nearly the same signal. These estimators were found superior to the standard monthly core inflation estimator in Japan, i.e. the CPI less fresh food.

However, in India, Samanta (1999) computed four different types of exclusion based core inflation and found that some of the exclusion-based core inflation measures are superior to the measured inflation for the purpose of monetary policy. He did not compute and compare the other measures of core inflation in Indian context. Uzagalieva (2005) also investigates core inflation in the Krygyz Republic on the basis of exclusion, trimmed mean and percentile, and found that trimmed means and exclusion based core measures are preferable, particularly in the period of decline in inflation.

Interestingly, Rich and Steindel (2005), in the US data, recently found no single individual measure of core inflation that can be considered superior to other measures. They measured various core inflations by applying exclusion methods, median and exponentially smoothing methods. In similar line, Landau (2000), in Germany data, have found very poor outcome from core inflation. Hence, he advises that it would be better not to use core inflation rate as the sole monetary policy indicators , but he agrees that core inflations are useful supplement to measured inflation.

Hence, the choice or identification of the preferred measures of core inflation appear to be an open empirical question which need to be tested on country specific data. It can be affected by the pattern of expenditure weight, goods in CPI basket and the factors that affect the price movement.

V. Data Coverage and Methodology Applied

For the computation of core inflation in Nepal, monthly indexes between 1996/97 and 2004/05 were used because it is the index series which is based on the recent base year and revised weight (Appendix 2), and comparatively more disaggregation figures are available on these data. Data on 33 components of National Urban Consumer Price Index

from mid-August 1996 to mid-July 2005 are used to calculate the various measures of core inflation.

Moreover, inflation is measured or defined as the change in the natural log of the price level for analysis. As there are no seasonally adjusted price series published in Nepal, the results cannot be filtered out from the seasonal effects. Hence, year-on-year monthly change in price has been calculated in this paper.

Y-o-Y price change or inflation has been calculated as

$\pi_t = 100*\ln(CPI_t/CPI_{t-k})$,

k=12 months

As discussed earlier, there is no unique and consensus method to measure the core inflation. However, based on the above discussion of the different methodologies , the following methods are applied to measure core inflation in the Nepalese context, considering the nature of data availability.

(a) exclusion method- three different core inflation series have been computed by excluding different commodities from the CPI basket.
(b) stochastic method –weighted median, and trimmed mean (5 different trimmed core inflation series have been computed)

These methods tend to be robust, credible and verifiable. However, these methods will be tested later on by applying various criteria to select the best one, among others. To select the best core that fits with the Nepalese price data, some criteria have been used, such as observing statistical properties, tracking the trend line, examining the relationship with money and evaluating the forecasting ability.

VI. DISTRIBUTION OF PRICE CHANGES IN NEPAL

The shape of distribution of price changes is reflected in the moments of the cross-sectotional distribution of price changes. For a symmetric distribution, the coefficient of skewness should be zero and the coefficient of kurtosis should be three. At that time, the mean can be an unbiased estimators of the distribution. But, the actual distribution of price changes, on an average, during the sample period, has positive skewness and high kurtosis (Table 1). The positive skewness shows that the distribution is skewed to the right, which means exceptional price rises are more common or more extreme than the exceptional price declines (Tahir, 2003). A skewed distribution implies the existence of predominance of outliers in price changes, resulting in a distortion in the general trend of inflation. Moreover, the high kurtosis (i.e. leptokurtic) indicates that exceptionally large price changes are much common than in a normal distribution. In this way, CPI inflation calculated on the basis of weighted mean in case of high skewness and kurtosis, cannot be 'robust' indicator of the general trend of inflation, it is just a biased estimator of the central tendency.

TABLE 1: Moment of Price Changes#*

	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	Average
Arithmetic mean	7.8	8.1	10.3	3.5	2.4	3.0	4.6	3.6	4.1	5.24
Variance	27.2	61.0	133.3	150.3	121.8	34.3	51.1	36.0	28.5	71.50

SD	5.0	7.5	11.4	11.8	10.9	5.8	7.0	6.0	5.2	7.84
Skewness	0.4	1.0	1.3	-1.3	-0.4	-0.6	0.3	-0.2	1.7	0.25
Kurtosis	7.1	7.2	7.0	6.5	4.0	9.3	9.7	8.2	9.7	7.65
Jarque-Bera Statistic	22.6	35.4	27.8	18.7	3.0	66.5	53.0	46.9	77.6	39.07
Normality test	reject	reject	reject	reject		reject	reject	reject	reject	reject

 # Calculations are based on year-on-year monthly inflation

** Using the adjusted formulae (Roger, 2000a), moments of the distribution of CPI component were calculated.*

Table 1 shows that the distribution of the prices is not normal, typically having excess kurtosis and positively skewed on an average. The Jarque-Bera tests for normality, a joint test of deviations of the observed skewness and kurtosis from the normal distribution with values of zero and 3 respectively, reflect that the hypothesis of normality is rejected except in that of one year 2000/01. As such, the mean does not adequately represent the price movement with the median or trimmed mean measures-are likely to give much more reliable indication of the general trend of inflation than the CPI mean.

There are different reasons for asymmetric distribution of price change. Bryan and Ceccheti (1993) argue that price setters face a one-time cross-sectional shock and can pay a menu cost to adjust their price to it immediately. Only those price setters whose shocks were large enough will choose to change. As a result, the distribution of shocks is skewed, concentrating in certain sectors of the economy (Bryan and Cecchetti, 1993). Moreover, the practice of collecting prices of different goods in different frequency, such as weekly, fortnightly, monthly, half yearly and annually, also results in asymmetric distribution of price change. Infrequent price adjustment by the government on the administered items also caused the unequal relative shocks on the distribution of price changes.

Over the entire sample period, the annual average skewness was 0.25 which is similar to other findings like the skewness of 0.2 found by Bryan et al (1997) for US price changes, and the skewness of 0.6 found by Roger (1997) for New Zealand.

Further, Appendix 3 shows descriptive statistics of the price change of different components in CPI basket during the review period. Highly volatile items fall under the food and beverage group. It is interesting to note that many items in the CPI basket witnessed, not only rise in price,but also fall in price in certain times during the review period.

VII. MEASURES OF CORE INFLATION

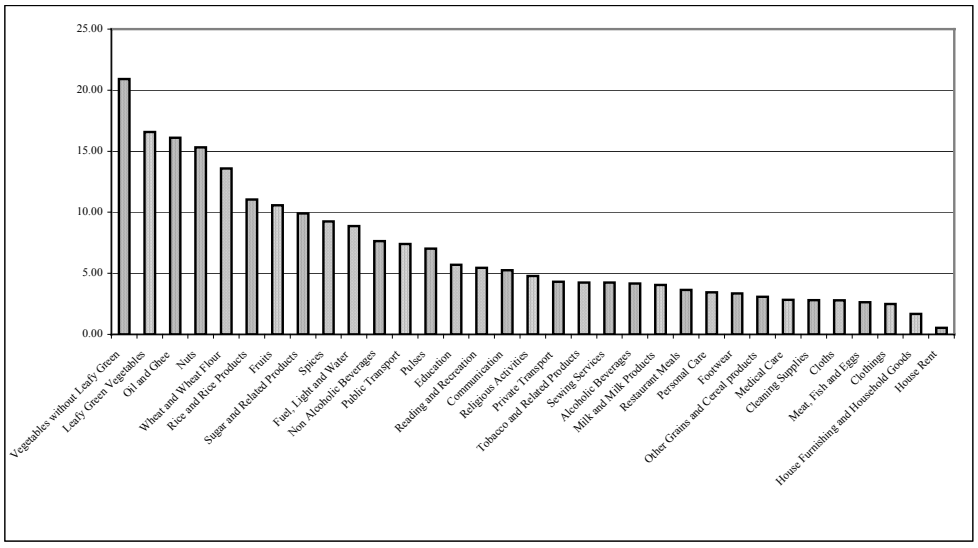
This section measures the core inflation in Nepal for the period of 1996/97:1 to 2004/05:12. Based on nature of data availability, stochastic measures and exclusion principle have been applied to derive core inflation. Empirical outputs of core inflation are subsequently explained below.

7.1 Exclusion Based Core Measures

The core inflation measure using exclusion principle possesses some merits such as they are readily understandable, easy to compute, transparent and easily variable, but it has some demerits such as involving subjectivity in deciding items to be excluded from the basket and also suffers from a potential risk of information loss (Tahir, 2003). In this section, an attempt has been made to provide a measure of core inflation for the Nepalese economy considering the peculiarities of price behaviour in Nepal based on the exclusion principle. The first crucial task necessary in using the exclusion-based measure of core inflation, is to identify the commodities/components which can be permanently excluded from the basket. A general rule is to exclude commodities whose prices are presumed to be prone to supply shocks and/or are under administrative control. Prices of these commodities for the most part are beyond the control of central bank or the preview of monetary policy. In this context, many central banks exclude 'food and energy' and/or 'government controlled/administered' prices and calculate price indices by readjusting weights of the rest of the commodities.

In the Nepalese context, the prices of food, pulses, vegetable, fruits and nuts, oil and ghee as well as sugar and related products are expected to be prone to supply shocks and vary from season to season, depending upon the production and availability/scarcity of these commodities in the market. Moreover, there are a number of items (see Appendix 3) whose prices are still administered by the government. Experience shows that government infrequently changes the prices of these goods.

FIGURE 1 : Standard Deviation of CPI Component, 1996/97:1 – 2004/05: 12



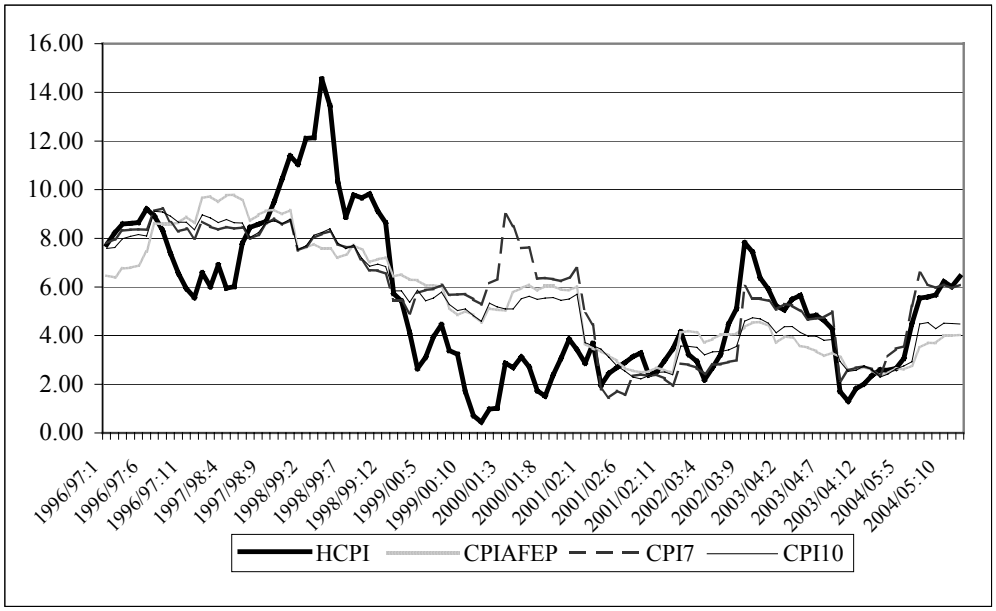
In applying the exclusion principle, it is important to remember that more exclusion of items of CPI basket results in less reliability of the data, due to a lower coverage. Hence, step by step, different core inflation by applying exclusion principle have been computed and tested for their superiority. First, CPI excluding food and energy (CPI*FE) has been computed in which grain and grain product, and fuel, light and water are excluded. In addition, the prices of a number of commodities in Nepal are also administered (Appendix 3) accounted for a 16.15 percent weight. As most of the administered items are grouped together under different headings, it is difficult to distinguish them and remove them from the subgroup level. However, fuel, light and water as well as communication can be removed from the CPI basket in the subgroup level as administered items. Hence, the second core inflation, CPI excluding food, energy and other administered items such as public transports and communication (CPI*FEP) has been computed. However, depending on the movement of price changes, these two exclusion based core inflations could not capture the core part of the price movement because the exclusion is not sufficient to exclude the supply shocked items. Hence, CPI*FE and CPI*FEP have been dropped out from further analysis. In addition, by excluding all items in food and beverage group except beverage and restaurant meal, and fuel, light and water, public transport and communication, the third core inflation, CPIAFEP, has been computed.

In the above methods, the selection of items for exclusion is guided by the general practice found in the other countries. To select the specific components for exclusion, one can identify the nature of the volatility in past by observing the historical performance of price series. Figure 1 shows the degree of volatility observed during the period under consideration of different components of CPI basket. Consequently, the fourth core inflation observed during the review period, have been calculated, named as CPI7. This CPI excludes the top seven highly volatile items, that have double digit standard

deviation,. These seven highly volatile items include (a) vegetables without leafy green, (b) leafy green vegetables, (c) oil and ghee, (d) nuts, (e) wheat and wheat flour, (f) rice and rice products, and (g) fruits (see Appendix 4 and Figure 1). In addition, since these seven items do not include the administered items like fuel, light and water, and public transport, another exclusion based core inflation, by excluding top 10 volatile items, has also been calculated, as indicated by CPI10. All of these core inflation have been reported in Appendix 5. Figure 2 shows the movement of these core measures.

However, it should be remembered that expenditures on food terms constitute a large share of the total expenditure in Nepal, as in many developing countries, but different from the developed ones. Together with energy prices, food items constitute approximately a third of weight in the CPI basket. Hence, excluding food and energy prices from the CPI may not be a good indicator of long-term inflationary trend since it constantly ignores a large portion that the consumers spend from their budgets. Moreover, this type of exclusion from CPI basket has a weak economic justification, as it is not necessary that noise only comes from the items excluded or the leftover items do not have shocks. Moreover, this method is based on the implicit assumption that the components of inflation exhibit similar behaviour in the future as in the past. Hence, the stochastic measures are also applied to compute the core inflation.

FIGURE 2 : Exclusion based Core Inflations



Note: NCPI – Headline inflation

7.2 Core Inflations from Stochastic Approaches

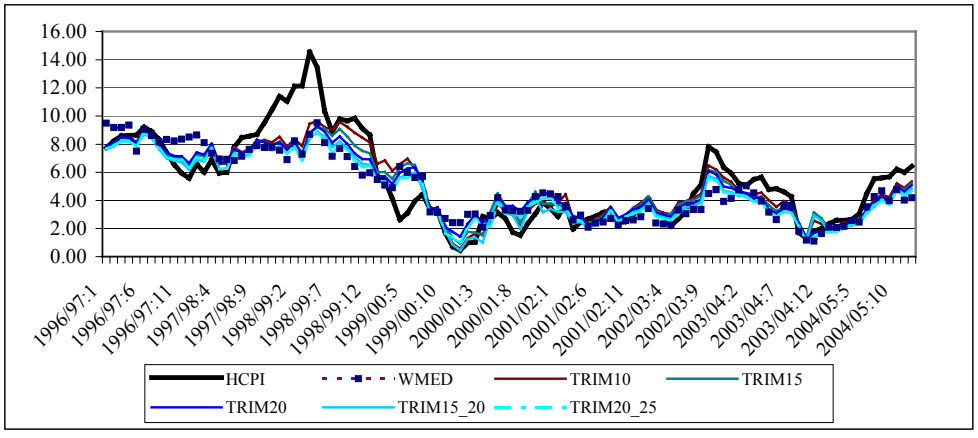
Excluding items from CPI basket in exclusion principle, a priori, may sometimes loose the information because the price of these items may not necessarily be volatile always. Hence, stochastic measures or limited influence estimators have been evolved. Instead of defining the more volatile components that are to be excluded a priori, for each observation, the stochastic measures look at the cross-sectional distribution of price changes to identify outliers.

On extreme stochastic measure of core inflation is weighted median, identifying the item on the median position as a representative for the distribution. Core inflation as measured by the weighted median is presented in Appendix 5 as indicated by WMED.

Regarding the trimming process, one needs to identify the optimal trim, which can be done by minimising Root Mean Square Error (RMSE) from the trend inflation. However, for the simplicity, three symmetric trimmed core inflations such as 10%, 15% and 20% have been computed in the line with the other studies. In this process, cross-sectional distribution of price change is sorted in ascending order. Then, this process excludes the items lie beyond the range set for the trimming. After that, it calculates the mean by re-weighting the remaining items. Resulted core inflation (trimmed mean) is depicted in Appendix 5 as indicated by TRIM10, TRIM15 and TRIM20.

Moreover, the mean percentile has been found as 53.02 consistently being greater than 50 indicate a persistent tendency toward right skewness in the distribution of price change. As such, asymmetric trimming process, trimming more on right tail, 15 percent left, 20 percent right and 20 percent left, 25 percent right have also been computed. Results are reported in Appendix 5 denoted by TRIM15_20 and TRIM 20_25. Figure 3 shows the movement of trimmed core measures and weighted median.

FIGURE 3: Weighted Median and Trimmed Core Inflations



Note: NCPI – Headline inflation

VIII. EVALUATION OF CORE INFLATIONS: WHICH MEASURE?

Out of many measures, we should select the best measures. Of the more than a dozen measures of core inflation have been computed in Nepalese data, four of them, CPI*FE, CPI*FEP, TRIM6_10, TRIM10_20 have been dropped outrightly because they could not capture the persistent part of headline inflation based on the character of distribution of price movement and weight assigned to each components in sub-group level. Nine different core inflation measures have been taken for further analysis. There are several criteria for selecting the best measure. For example, core inflation should be less volatile, and correlated with headline inflation. Moreover, if should follow the long run trend, and have close relationship with money. It must capture the persistent part of the headline inflation and must have some sort of forecasting ability.

8.1 Statistical Properties

Table 2 lists some descriptive statistics of various measures of core inflation and headline inflation (HCPI). The mean over the full sample ranges from 4.68 for the TRIM15_20 to 5.78 for CPI7. Measures of variability, shown by standard deviation, range from a low of 2.18 for CPI10, the least variable measure, to 2.44 for TRIM10. Moreover, all core inflation measures have volatility lower than that of headline CPI i.e. 3.09. It shows that core inflations are less volatile than the headline inflation. Hence, the core measures would increase the credibility of the monetary authority on conducting monetary policy.

TABLE 2: Statistical Properties of Various Measures of Core Inflation 1996/97:1 to 2004/05:12

	HCPI	CPIAFEP	CPI7	CPI10	WMED	TRIM10	TRIM15	TRIM20	TRIM15_20	TRIM20_25
Mean	5.35	5.49	5.78	5.46	4.91	5.14	5.06	5.02	4.68	4.69
Maximum	14.55	9.79	9.22	9.11	9.51	9.63	9.17	9.28	8.90	8.84
Minimum	0.45	2.34	1.45	2.21	1.11	0.56	0.94	1.31	0.45	1.03
Std. Dev.	3.09	2.25	2.26	2.18	2.37	2.44	2.31	2.26	2.28	2.23
Skewness	0.70	0.35	-0.33	0.24	0.43	0.20	0.22	0.27	0.24	0.30
Kurtosis	2.82	1.90	1.90	1.72	1.84	1.77	1.71	1.69	1.77	1.73

Of course, core inflations are fund less volatile that headline inflation, but it should be correlated with the latter for public accountability. A higher departure from headline inflation cannot represent the public sentiment of cost of living index. Therefore, that core measure can be taken as the best which has a higher degree correlation with the headline inflation. For this perspective, Table 3 shows the correlation coefficients between the headline inflation and different measures of core inflation. Comparatively, the correlation coefficient between headline inflation and TRIM10 is higher (0.92) than that of others, followed by the correlation with TRIM15, and TRIM15_20. It means that trimmed measures of core inflation are more closely correlated with headline inflation than the exclusion based core inflations.

TABLE 3: Correlation Matrix of Various Measures of Inflation

	HCPI	CPIAFEP	CPI7	CPI10	WMED	TRIM10	TRIM15	TRIM20	TRIM15_20	TRIM20_25
HCPI	1.00									
CPIAFEP	0.65	1.00								
CPI7	0.66	0.87	1.00							
CPI10	0.74	0.97	0.92	1.00						
WMED	0.83	0.85	0.82	0.92	1.00					
TRIM10	0.92	0.77	0.69	0.82	0.92	1.00				
TRIM15	0.90	0.81	0.73	0.86	0.94	0.99	1.00			
TRIM20	0.89	0.84	0.78	0.89	0.97	0.98	0.99	1.00		
TRIM15_20	0.90	0.80	0.73	0.86	0.95	0.99	1.00	0.99	1.00	
TRIM20_25	0.89	0.83	0.78	0.89	0.97	0.98	0.99	1.00	0.99	1.00

8.2 Tracking Trend Inflation

The long-term trend in CPI reflects the perception of the inflation by public in real terms (Berkman, 2002). A good measure of inflation should track trend inflation in two ways: first, over a long period of time, the average rate of core inflation should match with the average rate of headline inflation; second, the core inflation should move closely with the trend rate of inflation. Most policymakers prefer a measure of core inflation that neither understates nor overstates the long-term trend rate of price change. Whether core inflations follow the trend inflation or not, has been identified by computing the RMSE between trend inflation and core infation based on the following formula:

$$\text{RMSE}^{\text{core}} = \sqrt{\Sigma_t(\pi_t^{\text{TREND}} - \pi_t^{\text{CORE}})2/\text{T}}, \ \text{t} = 1,\ldots..,\text{T} \qquad (1)$$

Here, following the Bryan and Cecchetti (1993), a centered moving average of 24-month of CPI based inflation has been taken as a trend inflation to compute the RMSE for core inflation measures. Table 4 reports the RMSE which compares the how close each core measure captures the benchmark trend. It appears that the TRIM15 more closely approximates the persistent movement, followed by the TRIM20 and TRIM10. The reported RMSE suggests that all core measures, except CPI7 capture inflation trend better than then HCPI. It means the core measure provide a clear indication of current and future trends.

TABLE 4: Root Mean Square Error

Inflations	RMSE	Inflations	RMSE
HCPI	1.78	TRIM10	1.16
CPIAFEP	1.47	TRIM15	1.11
CPI7	2.05	TRIM20	1.15
CPI10	1.35	TRIM15_20	1.24
WMED	1.28	TRIM20_25	1.28

Moreover, RMSE is also used to identify the optimum trim. As per the RMSE, optimal trimming ratio is found to be 15 percent in both side of price distribution, which is similar to the finding of Tahir (2003) in Pakistan and Bryan and Cecchetti (1993) in the USA.

8.3 Core Inflation and Money Growth

Bryan and Cecchetti (1993) argue that a primary motivation for study of core inflation is to find a measure that is highly correlated with money growth, hence useful to conduct monetary policy. Bryan and Cecchetti (1999) also mention that among the properties generally attributed to an inflation estimate, is its underlying association with the growth rate of the money stock. Subsequently, the contemporaneous correlation between the growth rate of money stock (M_1 and M_2) and the several core inflation measures have been examined. The correlations were computed for annual percentage change of both monetary aggregates and the different measures of core inflation. The results are reported in Table 5. Interestingly, all exclusion based core inflation yield larger contemporaneous correlation with money growth than the headine and trimmed based core inflations.

TABLE 5: Contemporaneous Money Growth Correlations

	HCPI	CPIAFEP	CPI7	CPI10	WMED	TRIM	TRIM 10	TRIM 15	TRIM 15_20	TRIM 20_25
M_1	0.11	0.16	0.18	0.14	0.06	0.08	0.07	0.08	0.04	0.07
M_2	0.40	0.52	0.53	0.52	0.39	0.40	0.40	0.41	0.37	0.39

To examine whether the change in money growth actually forecast changes in inflation, Granger-Causilty has been done as:

$$\pi_1 = \alpha + \sum_{i=1}^{n} \beta_i \pi_{t-1} + \sum_{i=1}^{n} \lambda_i m_{t-1} + \Sigma_t \qquad (2)$$

where, π = various measures of inflation
m = growth of money (narrow and broad money)
Results for n = 24 are presented here.

Table 6 shows the results of the Granger Causality Test considering the growth of narrow money. A lag of 24 months seems to be representative based on the the concept that monetary policy has impact on inflation on long lags. Results show that the null hypothesis of growth of M1 does not Granger cause CPIAFEP and CPI10 are rejected at 5 percent significant level. It means that narrow money growth significantly Granger cause core inflations such as CPIAFEP and CPI10. But, narrow money growth does not Granger cause other measures of core inflation including headline inflation.

TABLE 6: Pairwise Granger Causality Tests Between Narrow Money and Core Inflation Measures
Sample: 1996/97:01 2004/05:12

Lags: 24

Null Hypothesis	Obs	F-Statistic	Probability
HCPI does not Granger Cause M_1	84	1.35003	0.20517
M_1 does not Granger Cause HCPI		0.58876	0.91117
CPIAFEP does not Granger Cause M_1	84	1.29180	0.24035
M_1 does not Granger Cause CPIAFEP		1.93772	0.03643
CPI7 does not Granger Cause M_1	84	1.27178	0.25354
M1 does not Granger Cause CPI7		0.93174	0.56482
CI10 does not Granger Cause M_1	84	0.76483	0.75142
M_1 does not Granger Cause CPI10		2.30821	0.01185
WMED does not Granger Cause M_1	84	1.04618	0.44315
M_1 does not Granger Cause WMED		1.05124	0.43810
TRIM10 does not Granger Cause M_1	84	1.41951	0.16906
M_1 does not Granger Cause TRIM10		0.47570	0.96984
TRIM15 does not Granger Cause M_1	84	1.10112	0.39014
M_1 does not Granger Cause TRIM15		1.01535	0.47459
TRIM1520 does not Granger Cause M_1	84	1.03128	0.45820
M_1 does not Granger Cause TRIM1520		1.04728	0.44205
TRIM20 does not Granger Cause M_1	84	1.72453	0.06934
M_1 does not Granger Cause TRIM20		0.34706	0.99579
TRIM2025 does not Granger Cause M_1	84	1.49340	0.13696
M_1 does not Granger Cause TRIM2025		0.36046	0.99455

Table 7 further reports the Granger Causality tests between broad money growth and the different core measures including the headline inflation. Of the different core measures and headline inflation, M2 growth only Granger causes CPIAFEP and CPI7 for which null hypothesis is rejected at 5 percent level and 10 percent level respectively. However, TRIM 20 and TRIM20_25, instead of Granger caused by M_2 growth, they themselves Granger cause the M2 growth.

TABLE 7: Pairwise Granger Causality Tests Between Broad Money and Core Measures
Sample: 1996:08 2005:07
Lags: 24

NULL HYPOTHESIS	Obs	F-Statistic	Probability
HCPI does not Granger Cause M_2	84	1.17591	0.32492
M_2 does not Granger Cause HCPI		0.56545	0.92641
CPIAFEP does not Granger Cause M_2	84	1.51337	0.12929
M_2 does not Granger Cause CPIAFEP		2.01204	0.02907
CPI7 does not Granger Cause M_2	84	0.81556	0.69571
M_2 does not Granger Cause CPI7		1.69278	0.07625
CPI10 does not Granger Cause M_2	84	0.92507	0.57224
M_2 does not Granger Cause CPI10		1.52965	0.12333
WMED does not Granger Cause M_2	84	1.48570	0.14003
M_2 does not Granger Cause WMED		1.43389	0.16233
TRIM10 does not Granger Cause M_2	84	1.64670	0.08745
M_2 does not Granger Cause TRIM10		0.42761	0.98374
TRIM15 does not Granger Cause M_2	84	1.40344	0.17688
M_2 does not Granger Cause TRIM15		0.85951	0.64618
TRIM1520 does not Granger Cause M_2	84	1.29687	0.23710
M_2 does not Granger Cause TRIM1520		0.94223	0.55318
TRIM20 does not Granger Cause M_2	84	3.05495	0.00133
M_2 does not Granger Cause TRIM20		0.51021	0.95598
TRIM2025 does not Granger Cause M_2	84	2.83166	0.00252
M_2 does not Granger Cause TRIM2025		0.51840	0.95218

Relationship with money can also help determine the selection of core inflation. The best core inflation should be explained by the money stock so that monetary policy can influence significantly. The estimating equation is taken as

$$\Delta \ln P_t = \alpha + \beta \Delta \ln M_t + \varepsilon_t, \quad (3)$$

where,

$\Delta \ln P_t$ = first difference of natural logarithmic of price indexes, indicating inflation

$\Delta \ln M_t$ = first difference of natural logarithmic of money supply.

Expected signs of coefficient : $\alpha <> 0$, $\beta > 0$, β will show us the degree of influence of change in money stock on change in price.

Before running OLS on equation (3), it would better to test for unit root test, otherwise regression results would be spurious. Table 8 reports the Augmented Dickey Fullller (ADF) test for all measured of core inflations, headline inflation and money supply M1 and M_2. ADF has been calculated at first lag with intercept but no trend.

TABLE 8: Unit Root Test

Variables in Level	ADF Value	Variables in Difference	ADF Value
Ln (HCPI)	-1.13	Dln (HCPI)	-5.68*
Ln (CPIAEFP)	-2.82	Dln (CPIAEFP)	-8.51*
Ln (CPI7)	-2.13	Dln (CPI7)	-7.20*
Ln (CPI10)	-3.15	Dln (CPI10)	-8.28*
Ln (WMED)	-1.69	Dln (WMED)	-10.79*
Ln (TRIM10)	-1.52	Dln (TRIM10)	-8.97*
Ln (TRIM15)	-1.52	Dln (TRIM15)	-9.34*
Ln (TRIM20)	-1.55	Dln (TRIM20)	-9.01*
Ln (TRIM1520)	-1.62	Dln (TRIM1520)	-9.69*
Ln (TRIM2025)	-1.63	Dln (TRIM2025)	-9.08*
Ln (M_1)	-0.9	Dln (M_1)	-11.03*
Ln (M_2)	-2.39	Dln (M_2)	-8.98*

* MacKinnon critical values for rejection of hypothesis of a unit root are
1% Critical Value* -3.4870
5% Critical Value -2.8861
10% Critical Value -2.5797
Note: ln – natural log D – difference

ADF statistics in the above table shows that all variable under consideration are stationary in first difference. Hence, OLS estimation on equation (3) is proceeded. Empirical results at lag length of 7 months have been found representative in case of M1 and 10 months in case of M2 which seems to be reasonable because monetary policy has lags effect on inflation. Empirical results are presented in the following Table 9 and Table 10.

Function Relationship of Different Inflation Measures with M_1

Regression results of equation (3) taking narrow money as an independent variable are presented in Table 9. β coefficients are significant at least at 5 percent significant level for all types of core inflation measures while it is significant at 10 percent for headline inflation. Of the various core measures, β coefficient is the highest in case of WMED, followed by TRIM15_20 and TRIM15. It means that WMED responses highly to change in narrow money, subsequently by TRIM15_20 and TRIM15. It also implies that narrow money aggregate influences WMED, then TRIM15_20 and TRIM15 significantly.

Adj/R^2 shown in column 4 reflects the higher explanatory power for core measures compared to headline inflation. However, the value of Adj/R^2 in all cases are below 10 percent which is usual in case of regression run in first difference of log value, and inflation in Nepal is caused by the factors other than money. Of the Adj/R^2 for various core measures, explanatory power of narrow money is higher in case of CPI10, followed by WMED.

TABLE 9: Regression Results of Different Inflation measures with Narrow Money

Dependent Variable	α	β	Adj/R^2	DW	AIC	SC	F-stat
HCPI	0.004	0.064***	0.018	1.13	-6.02	-5.97	3.04***
	(0.00)	(0.08)					
CPIAFEP	0.004	0.060*	0.069	2.22	-7.25	-7.20	9.26*
	(0.00)	(0.003)					
CPI7	0.004	0.053**	0.049	2.04	-7.17	-7.13	6.71**
	(0.00)	(0.011)					
CPI10	0.004	0.063*	0.099	2.14	-7.52	-7.47	13.15*
	(0.00)	(0.00)					
WMED	0.00	0.29*	0.078	2.26	-4.22	-4.17	10.45*
	(0.75)	(0.002)					
TRIM10	0.00	0.17**	0.043	2.05	-4.69	-4.64	6.01**
	(0.33)	(0.016)					
TRIM15	0.00	0.20*	0.054	2.11	-4.60	-4.56	7.31*
	(0.41)	(0.008)					
TRIM20	0.00	0.17**	0.037	2.08	-4.58	-4.53	5.29**
	(0.37)	(0.023)					
TRIM15_20	0.00	0.21*	0.06	2.04	-4.60	-4.55	8.06*
	(0.53)	(0.005)					
TRIM20_25	0.00	0.16*	0.033	2.09	-4.59	-4.54	4.80**
	(0.42)	(0.03)					

* significant in 1 percent level
** significant in 5 percent level
*** significant in 10 percent level
p value in bracket
AIC = Akaike info criterion
SC = Schwarz criterion

DW statistics shows the existence of serial correlation in the dependent variable, value of which should remain around 2 for no serial correlation, both positive and negative. The value of DW statistics is very low in case of headline inflation (HCPI) reflecting the positive serial correlation. However, the other core measures have DW stat around 2.

Table 9 also shows the value of AIC and SC. Higher negative value of them is better for the model. As per this value, CPI10 seems to perform better followed by CPIAFEP. F-statistics also supports the CPI10 followed by WMED, values of which are significant at 1 percent level.

Functional Relationship of Different Inflation Measures with Broad Money

Broad money has been taken as monetary target in conducting monetary policy in Nepal. Hence, it is imperative to look the functional relationship between the different inflation measures with broad money as well. Here, broad money includes narrow money plus time deposits.

TABLE 10: Regression Results of Different Inflation Measures with Broad Money

Dependent Variable	α	β	Adj/R^2	DW	AIC	SC	F-stat
HCPI	0.004	0.017	-0.009	1.12	-5.98	-5.93	0.04
	(0.006)	*(0.84)*					
CPIAFEP	0.003	0.16*	0.095	2.16	-7.25	-7.20	12.34*
	(0.00)	*(0.00)*					
CPI7	0.004	0.10**	0.031	2.07	-7.13	-7.08	4.50**
	(0.00)	*(0.036)*					
CPI10	0.003	0.14*	0.095	2.10	-7.49	-7.44	12.28*
	(0.00)	*(0.00)*					
WMED	-0.004	0.70*	0.08	2.11	-4.20	-4.15	10.96*
	(0.28)	*(0.001)*					
TRIM10	0.000	0.43*	0.05	2.00	-4.67	-4.62	6.81**
	(0.77)	*(0.010)*					
TRIM15	-0.002	0.50*	0.064	2.06	-4.59	-4.54	8.34*
	(0.59)	*(0.004)*					
TRIM20	0.00	0.37**	0.03	2.04	-4.55	-4.50	4.40**
	(0.94)	*(0.038)*					
TRIM15_20	-0.002	0.53*	0.071	1.99	-4.58	-4.53	9.20*
	(0.45)	*(0.003)*					
TRIM20_25	0.00	0.35**	0.026	2.05	-4.55	-4.50	3.93**
	(0.92)	*(0.05)*					

* significant in 1 percent level
** significant in 5 percent level
*** significant in 10 percent level
p value in bracket
AIC = Akaike info criterion
SC = Schwarz criterion

Estimate of the equation (3) considering broad money as an explanatory variable reveals that results are representative when M2 growth is taken at 10 months lag. It means that M2 growth exerts influence on core measures after lag of 10 months. Table 10 shows the empirical results of estimate of equation (3) considering broad money in right hand side. As expected, there is no any significant relationship between headline inflation and M2 growth, but all measures of core inflation have the significant β coefficient. It shows

that core measures are better explained by the money growth compared to headline inflation.

Of the β coefficients, WMED has the highest value, followed by TRIM15_20 and TRIM15 which is similar to the findings above taking narrow money in right hand side. However, the explanatory power of M_2 is higher in case of CPI10 and CPIAFEP, followed by WMED than that of others. DW stat shows that existence of serial correlation in case of headline inflation when it is taken as a dependent variable.

AIC and SC values shows the models with CPI10 found better followed by CPIAFEP and CPI7. Moreover, F-statistics of the all models are significant, highest value for CPIAFEP, followed by CPI10 and WMED.

All of these discussions in this section can prove that the core measures are more correlated with or controllable through monetary aggregates.

8.4 Testing the Relative Shocks

Headline inflation is supposed to contain both common trend and a temporary component, called relative price shock. By this definition, we have

$$\pi_t = \pi_c + u_t \qquad (4)$$
$$\pi_t - \pi_c = u_t$$

where π_t is headline inflation and π_c is core inflation and u_t is relative price shocks

The temporary disturbances u_t are caused by development such as change in weather conditions, disturbance in supply side. By definition, u_t is expected to have zero mean and finite variance or in other words, it should be stationary. If not, that would mean that the core inflation measure, π_c ,would not be capturing all the systematic component of π_t and there is a non vanishing difference between headline and core inflation. In this case, the core measure does not capture the true level of the permanent component of inflation and may give false signals to monetary authorities if they do not take this into consideration (Marques et.al, 2000). Hence, $\pi_t - \pi_c = u_t$ should be stationary which can be tested by ADF statistics.

Table 11 presents the ADF test on u_t. All relative shocks, except in case of WMED and TRIM15_20 are stationary reflecting that the corresponding core measures are capturing the permanent component of headline inflation.

TABLE 11: ADF test on Relative Shocks

	CPIAFEP	CPI7	CPI10	WMED	TRIM 10	TRIM 15	TRIM 20	TRIM 15_20	TRIM 20_25
ADF test on $(\pi_t - \pi_c)$	5.91*	5.77*	6.99*	2.47	3.19**	3.0**	2.86***	2.46	2.76***

* *Significant at 1 percent level*
** *Significant at 5 percent level*
*** *Significant at 10 percent level*

8.5 Forecasting Ability

In order to assess whether the core measure has any indicator property for the future trend in inflation, the simple correlations between each core measures and CPI inflation at various future intervals: 6 months, 12 months, 18 months, and 24 months have been calculated. Table 12 reports these correlation coefficients. Based on the correlation coefficients, forecasting ability of the core measures have been found mixed. However, they do contain information about future movements of inflation. The highest correlation of CPI inflation at 6 months is with TRIM15_20 and TRIM20_25, reported at 0.63; at 12 months is with CPIAFEP, reported at 0.53; at 18 months and 24 months is with WMED, reported at 0.43 and 0.37 respectively.

TABLE 12: Correlation of core Measures with future CPI inflation 1996/97:1 to 2004/05:12

	t	t+6	t+12	t+18	t+24
CPIAFEP	0.65	0.62	0.53	0.33	0.13
CPI7	0.66	0.49	0.35	0.28	0.25
CPI10	0.74	0.61	0.48	0.38	0.27
WMED	0.83	0.62	0.45	0.43	0.37
TRIM10	0.92	0.59	0.30	0.22	0.19
TRIM15	0.90	0.61	0.35	0.27	0.23
TRIM20	0.89	0.62	0.38	0.30	0.26
TRIM15_20	0.90	0.63	0.39	0.31	0.26
TRIM20_25	0.89	0.63	0.39	0.33	0.28

IX. CONCLUSION

Price stability has been a major objective of monetary policy in the recent years for the monetary authority to be more accountable and credible. However, conventional measures of price by consumer price index cannot isolate the supply shock effect on the price movement with which monetary policy has no any relationship. For the accountability and credibility of the monetary policy, there should be a measurement of core inflation, eliminating distortionary effects of supply shocks.

Distribution of price changes in Nepal has indicated that existence of high kurtosis and positive skewness rejecting normality proposition, which is also pointed out by the Jarque-Bera normality test statistic because of presence of supply shock and administered items. As such, the conventional measures of CPI by arithmetic mean can be inferior to represent the price movement. Therefore, it is imperative to compute core inflation.

Of the different measures computed in this article, none of the measures satisfies all the desirable properties of robustness, unbiasedness, efficient, timelines and credibility simultaneously. However, core inflation measures are better performed to headline inflation on conducting monetary policy on various ground. It has been found that core measures have less volatility, i.e. less susceptible to supply shocks, follow trend inflation and more responsive to money growth i.e. monetary policy than headline inflation. Since

there can be different measures of core inflation, an important matter is to select the best one. Comparison of performance of different core measures from different perspectives shows the mixed results in Nepal, no any one core measure is superior in all aspects. For example, CPI10 has the lower standard deviation, but TRIM10 has the strongest correlation with headline inflation. Tracking the trend inflation identifies TRIM15 performs better having the lowest RMSE. Further, CPI7 has the strong contemporaneous correlation with money growth. Looking from Granger causality performance, M1 Granger causes CPIAFEP and CPI10 while M2, Granger causes CPIAFEP and CPI7. Functional relationship with money further found that WMED is superior. Moreover, in the longer horizon, WMED is found to have forecasting ability. In this way, based on the various performance criteria, representative core inflation can be CPI10, CPI7, CPIAFEP, WMED and TRIM15.

However, most of the measures of core inflation seems to capture the permanent components because the relative shocks has been transitory in each core measure. As a result, instead of focusing on any single measure, it would be better to focus on various measures namely exclusion based like CPI10, trimmed based like TRIM15 and weighted median on conducting the monetary policy in Nepal.

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APPENDIX 1: International Practices of Measuring Core Inflation

Country	Measures of Core Inflation	
	Headline inflation adjusted for	Alternative Measures
Australia	Energy, mortgage interest, fruit, vegetables	Weighted median 30 percent trimmed mean
Belgium	*CPI less potatoes, fruit and vegetables*	

Canada	*CPIxFET*: food, energy, indirect taxes CPIX: fruits, vegetables, gasoline, fuel oil, natural gas, mortgage interest costs, inter-city transportation, tobacco products	• CPIW: multiply the initial CPI basket weights by the reciprocal of the historical standard deviation of the relative price change (to give non-zero but lesser weights to items with volatile price movements) • Wmedian and trimmed mean
Chile	CPI excluding perishable goods and energy	
Colombia	An average of four measures (CPI excluding food and three limited influence estimators)	
Czech Republic	Food, energy, indirect taxes	
Finland	*IUI*: Capital costs in owner-occupied housing, indirect taxes, subsidies	
France	CPI less change in taxes, energy prices, food prices and regulated prices	
Greece	CPI less food and fuel	
Israel	CPI less government goods, housing, fruit and vegetables	
Japan	CPI less fresh foods	
Netherlands	CPI less vegetables, fruit and energy	
New Zealand	- Interest services * - With an escape clause for "unusual events" concerning commodity, indirect taxes, controlled items	
Norway	CPI less electricity prices and indirect taxes	
Philippines	Rice, corn, fruits & vegetable, LPG, Kerosene, Oil, Gasoline and Diesel	
Poland	A set of three measures (CPI less officially controlled prices, CPI less prices with higest volatilities and a 15% trimmed mean)	
Portugal	10% trimmed mean of the CPI	
Singapore	CPI less cost of private road transportation and accommodation	
Spain	- IPSEBENE: energy, unprocessed food - Case-by-case: indirect taxes, exogenous prices	
Sweden	- UND1: interest costs for owner-occupied housing, indirect taxes, subsidies, depreciation after float - UND2: UND1 plus heating oil and propellants	
United Kingdom	• *RPIX*: mortgage interest payments • RPIY: mortgage interest payments, indirect • and local taxes • RPIXFE: RPIX plus food, fuel, light • TPI: direct taxes, THARP: indirect and local taxes	
Thailand	Rice and cereal products, meats, fruits & vegetables, electricity and gasoline	

Source: Bryan and Cecchetti (1999) and several central bank publications.

APPENDIX 2 : Weight in Consumer Price Index

		Weight 1983/84 base year	Weight 1995/96 base year
A)	FOOD AND BEVERAGES	62.63	53.20
1	Restaurant Meals	4.88	6.91
2	Grains and Cereal Products	29.43	18.00
3	Pulses	3.27	2.73
4	Vegetables and fruits	8.47	7.89
5	Spices	2.23	1.85
6	Meat, fish and eggs	4.07	5.21
7	Milk and milk products	3.76	4.05
8	Oil and ghee	3.36	3.07
9	Sugar and related products	1.68	1.21
10	Beverages	1.48	2.28
B)	NON-FOOD AND SERVICES	37.37	46.80
11	Cloths, Clothings and Sew. Services	10.09	8.92
12	Footwear	1.72	2.20
13	House Fur.& H.H.Goods	2.56	3.50
14	House Rent	1.33	4.19
15	Cleaning Supplies	1.89	1.26
16	Fuel, light and water	6.88	5.92
17	Transport and Communication	2.13	4.03
18	Medical and Personal Care	4.59	8.03
19	Education, Read., and Recreation	4.14	7.09
20	Tobacco & Related Products	2.04	1.66

APPENDIX 3 : Administered Items with Their Weightages (Kathmandu Valley)

	1983/84 Base Year		1995/96 Base Year	
S.N	Commodities	% wght	Commodities	Wght
1	Salt	0.17	Dairy Ghee	0.15
2	Curd	0.11	Salt	0.12
3	Bottle milk	3.14	Dairy Milk	3.08
4	Sugar	1.80	Dairy curd	0.08
5	Poplin (a kind of Cloth)	0.05	Sugar	1.26
6	Chhit cotton (akind of cloth)	0.07	Chhit cotton	0.03
7	Jin for Dress (a kind of cloth)	0.13	Kerosene	1.73
8	Kerosene	3.33	Petrol	0.53
9	Electricity Charge	1.39	Cetamol drug	0.71
10	Water Charge	0.32	Jeevan Jal drug	0.10
11	Bus fare long route	0.54	Cigarettes (Yak)	0.81
12	Bus fare Short route	0.28	Cigarettes (Gaida)	0.09
13	Trolley bus fare	0.31	Bus fare long route	0.45
14	Petrol	0.52	Bus fare Short route	1.05
15	Mobile loose	0.07	Hospital per bed charge	0.15
16	Telephone charge	0.18	National Magazine (Gorkhapatra)	0.16
17	Aerogram inland	0.04	School fee (IX, X)	2.49
18	Cetamol drug	0.20	College Fee (Undergraduate)	0.24
19	Piracite drug	0.03	Text book (IX,X)	0.22
20	Jeevan Jal drug	0.04	Telephone charge	0.48
21	School fee (IX, X)	1.56	Postal stamp	0.04
22	College Fee (Undergraduate)	0.34	Electricity Charge	1.83
23	Text book (IX,X)	0.43	Water Charge	0.36
24	National Magazine (Gorkhapatra)	0.11		
25	Cigarettes (Yak)	0.89		
26	Cigarettes (Gaida)	0.72		
27	Cigarettes (Deurali)	0.59		
	Total	17.35	Total	16.15

APPENDIX 4 : Volatility of Components in CPI Basket, 1996/97:1 – 2004/05:12

	Items	Weight	Mean	Max	Min	Std
1.	Vegetables without Leafy Green	5.15	3.95	66.88	-48.55	20.92
2.	Leafy Green Vegetables	1.10	4.52	49.20	-35.13	16.58
3.	Oil and Ghee	3.07	4.56	46.41	-37.23	16.09
4.	Nuts	0.05	7.78	29.15	-24.35	15.31
5.	Wheat and Wheat Flour	1.79	5.87	31.38	-28.75	13.60
6.	Rice and Rice Products	14.16	3.94	31.29	-19.33	11.04
7.	Fruits	1.59	5.66	28.93	-19.04	10.58
8.	Sugar and Related Products	1.21	4.83	32.97	-12.33	9.91
9.	Spices	1.85	4.24	24.51	-15.20	9.25
10.	Fuel, Light and Water	5.92	9.24	44.76	-14.97	8.89
11.	Non Alcoholic Beverages	0.75	3.45	24.27	-5.11	7.63
12.	Public Transport	2.54	8.76	20.97	-2.45	7.40
13.	Pulses	2.73	3.05	29.50	-13.58	7.04
14.	Education	4.78	8.26	18.33	-3.35	5.70
15.	Reading and Recreation	1.63	3.83	18.42	-2.96	5.45
16.	Communication	0.42	2.41	17.62	-17.70	5.24
17.	Religious Activities	0.68	6.03	15.88	-6.22	4.77
18.	Private Transport	1.07	5.91	14.17	-4.94	4.32
19.	Tobacco and Related Products	1.66	4.96	17.65	-0.07	4.24
20.	Sewing Services	0.89	6.55	25.83	-4.62	4.24
21.	Alcoholic Beverages	1.53	6.31	14.43	-1.65	4.17
22.	Milk and Milk Products	4.05	4.59	15.07	-0.89	4.03
23.	Restaurant Meals	6.91	7.28	12.89	0.77	3.66
24.	Personal Care	1.82	4.84	11.54	-0.26	3.45
25.	Footwear	2.20	3.24	11.60	-0.75	3.34
26.	Other Grains and Cereal products	2.05	3.94	13.13	0.07	3.08
27.	Medical Care	6.21	6.35	11.98	0.74	2.82
28.	Cleaning Supplies	1.26	3.88	11.54	-0.82	2.81
29.	Cloths	2.28	2.98	11.66	-5.20	2.79
30.	Meat, Fish and Eggs	5.21	5.80	11.68	1.18	2.64
31.	Clothings	5.75	3.78	9.11	0.36	2.49
32.	House Furnishing and Household Goods	3.50	3.41	6.35	-1.00	1.68
33.	House Rent	4.19	4.55	5.46	2.50	0.55

APPENDIX 5 : Headline Inflation and Different Core Inflations Monthly (y-o-y)

	HCPI	CPIAFEP	CPI7	CPI 10	WMED	TRIM 10	TRIM 15	TRI M 20	TRIM 15_20	TRIM 20_25
1996/97:1	7.73	6.47	7.80	7.58	9.48	7.81	7.81	7.87	7.62	7.67
1996/97:2	8.23	6.39	7.97	7.62	9.18	8.06	8.04	8.09	7.83	7.90
1996/97:3	8.59	6.75	8.32	7.98	9.20	8.45	8.45	8.47	8.21	8.27
1996/97:4	8.62	6.80	8.35	8.09	9.36	8.39	8.39	8.44	8.18	8.24
1996/97:5	8.65	6.88	8.37	8.15	7.51	8.17	8.14	8.09	7.88	7.84
1996/97:6	9.20	7.44	8.35	8.10	9.06	8.85	8.88	8.93	8.71	8.79
1996/97:7	8.91	8.62	9.13	9.11	8.61	8.50	8.59	8.68	8.41	8.50
1996/97:8	8.32	8.59	9.22	9.09	8.16	7.96	7.93	7.98	7.66	7.70
1996/97:9	7.39	8.59	8.65	8.91	8.32	7.18	7.27	7.39	6.99	7.10
1996/97:10	6.56	8.64	8.30	8.66	8.23	6.99	7.06	7.16	6.83	6.92
1996/97:11	5.94	8.90	8.39	8.66	8.35	6.88	6.99	7.14	6.71	6.89
1996/97:12	5.57	8.62	7.99	8.35	8.50	6.37	6.51	6.65	6.19	6.35
1997/98:1	6.59	9.65	8.69	8.96	8.65	7.00	7.21	7.42	6.86	7.05
1997/98:2	6.01	9.73	8.48	8.84	8.09	6.86	7.13	7.26	6.76	6.86
1997/98:3	6.90	9.49	8.36	8.65	7.35	7.62	7.89	8.02	7.59	7.72
1997/98:4	5.95	9.78	8.46	8.77	6.94	6.58	6.63	6.66	6.23	6.22
1997/98:5	6.01	9.79	8.41	8.63	6.93	6.65	6.68	6.65	6.28	6.25
1997/98:6	7.79	9.57	8.44	8.63	6.84	7.77	7.70	7.64	7.37	7.30
1997/98:7	8.45	8.73	8.00	8.04	7.13	7.44	7.37	7.37	7.07	7.02
1997/98:8	8.57	8.96	8.15	8.23	7.64	7.63	7.58	7.53	7.30	7.22
1997/98:9	8.70	9.13	8.59	8.64	7.88	8.16	8.18	8.30	7.88	8.00
1997/98:10	9.51	9.18	8.83	8.71	7.75	8.29	8.17	8.14	7.81	7.77
1997/98:11	10.44	8.99	8.56	8.60	7.77	8.14	7.97	7.93	7.58	7.57
1997/98:12	11.39	9.16	8.74	8.78	7.57	8.53	8.19	8.11	7.83	7.78
1998/99:1	11.04	7.56	7.49	7.54	6.90	7.82	7.66	7.62	7.36	7.31
1998/99:2	12.11	7.61	7.68	7.70	8.22	8.37	8.18	8.09	7.80	7.80
1998/99:3	12.13	7.77	8.02	8.13	7.29	7.86	7.38	7.18	6.91	6.78
1998/99:4	14.55	7.57	8.18	8.24	8.70	9.44	8.84	8.76	8.40	8.44
1998/99:5	13.46	7.57	8.29	8.39	9.51	9.63	9.17	9.28	8.90	8.84
1998/99:6	10.34	7.20	7.76	7.81	8.09	9.22	9.10	8.88	8.54	8.38
1998/99:7	8.87	7.34	7.63	7.58	7.14	9.01	8.58	8.11	7.80	7.39
1998/99:8	9.78	7.71	7.66	7.72	7.70	9.57	9.08	8.54	8.18	8.02
1998/99:9	9.66	7.54	7.07	7.18	7.11	9.23	8.54	8.01	7.72	7.54
1998/99:10	9.83	7.03	6.69	6.85	6.41	8.80	7.89	7.33	7.08	6.86
1998/99:11	9.12	7.14	6.68	6.94	5.78	8.46	7.51	6.95	6.60	6.35
1998/99:12	8.64	7.21	6.54	6.84	5.95	8.13	7.35	6.92	6.55	6.46
1999/00:1	5.72	6.44	5.42	5.83	5.48	6.60	6.01	5.75	5.39	5.34
1999/00:2	5.42	6.51	5.43	5.84	5.08	6.83	6.03	5.71	5.35	5.30
1999/00:3	4.12	6.29	4.91	5.36	4.89	6.10	5.53	5.17	4.84	4.77
1999/00:4	2.64	6.28	5.75	5.87	6.42	6.58	6.36	5.96	5.62	5.57
1999/00:5	3.11	6.06	5.87	5.43	5.97	6.95	6.62	6.25	5.86	5.62
1999/00:6	3.95	6.07	5.91	5.54	5.61	6.27	6.52	6.36	5.95	5.75
1999/00:7	4.45	6.01	6.07	5.79	5.70	4.83	5.08	5.37	4.87	5.17
1999/00:8	3.38	5.15	5.68	5.28	3.18	3.53	3.40	3.36	3.12	3.08
1999/00:9	3.24	4.84	5.69	5.03	3.14	3.28	3.31	3.50	3.05	3.25
1999/00:10	1.70	5.01	5.71	5.09	2.71	1.86	2.23	2.10	1.84	1.70
1999/00:11	0.71	4.84	5.48	4.83	2.41	0.95	1.32	1.77	0.85	1.37
1999/00:12	0.45	4.54	5.28	4.59	2.41	0.56	0.94	1.43	0.45	1.03
2000/01:1	0.98	5.11	6.14	5.33	3.02	1.33	1.78	2.35	1.26	2.07
2000/01:2	1.02	5.05	6.33	5.18	3.04	1.65	1.71	2.96	1.35	2.69
2000/01:3	2.87	5.04	8.97	5.09	2.09	1.62	1.52	2.49	1.01	2.16

	HCPI	CPIAFEP	CPI7	CPI 10	WMED	TRIM10	TRIM 15	TRIM20	TRIM 15_20	TRIM 20_25
2000/01:4	2.69	5.77	8.51	5.09	2.93	2.26	3.18	2.60	2.76	2.14
2000/01:5	3.12	5.95	7.60	5.51	4.20	3.77	4.52	4.23	4.09	3.83
2000/01:6	2.71	6.09	7.63	5.61	3.31	3.22	3.57	3.62	3.10	3.33
2000/01:7	1.74	5.85	6.34	5.49	3.27	2.95	3.37	3.60	2.96	3.20
2000/01:8	1.51	6.03	6.37	5.54	3.24	2.16	2.44	3.20	1.98	2.83
2000/01:9	2.37	6.03	6.32	5.57	3.30	3.28	3.76	3.89	3.28	3.55
2000/01:10	3.06	5.88	6.24	5.45	4.27	3.76	4.61	4.18	4.20	3.85
2000/01:11	3.85	5.86	6.40	5.50	4.53	3.95	3.76	4.46	3.15	4.15
2000/01:12	3.42	6.01	6.75	5.70	4.46	3.57	3.78	4.49	3.39	4.14
2001/02:1	2.87	3.66	4.89	3.71	4.28	3.83	3.67	3.86	3.21	3.47
2001/02:2	3.69	3.47	4.46	3.58	3.55	4.44	3.56	3.74	3.18	3.38
2001/02:3	1.96	3.34	1.79	3.44	2.60	2.65	2.72	2.88	2.38	2.60
2001/02:4	2.45	3.19	1.45	3.11	2.95	2.85	2.80	2.78	2.45	2.53
2001/02:5	2.69	2.96	1.74	2.75	2.09	2.36	2.28	2.27	1.98	1.99
2001/02:6	2.88	2.65	1.56	2.54	2.39	2.71	2.61	2.44	2.34	2.24
2001/02:7	3.13	2.55	2.34	2.29	2.47	3.06	2.87	2.79	2.61	2.56
2001/02:8	3.28	2.50	2.40	2.21	2.72	3.55	3.48	3.48	3.22	3.25
2001/02:9	2.38	2.52	2.35	2.35	2.25	2.77	2.73	2.71	2.51	2.45
2001/02:10	2.51	2.69	2.39	2.49	2.56	2.96	2.99	3.02	2.82	2.83
2001/02:11	2.99	2.57	2.23	2.50	2.60	3.49	3.44	3.36	3.16	3.03
2001/02:12	3.45	2.48	1.93	2.39	2.84	3.81	3.69	3.56	3.33	3.17
2002/03:1	4.15	4.12	2.85	3.57	3.41	4.26	4.27	4.07	3.82	3.70
2002/03:2	3.22	4.19	2.81	3.55	2.39	3.32	3.24	3.14	2.97	2.88
2002/03:3	2.93	4.12	2.67	3.51	2.32	3.13	3.01	3.00	2.80	2.68
2002/03:4	2.19	3.72	2.43	3.20	2.25	3.03	2.98	2.84	2.65	2.56
2002/03:5	2.69	3.85	2.80	3.33	3.30	3.85	3.68	3.50	3.26	3.03
2002/03:6	3.22	4.04	2.83	3.35	3.05	3.96	3.92	3.77	3.51	3.30
2002/03:7	4.49	4.04	2.91	3.41	3.36	4.19	4.01	3.81	3.60	3.38
2002/03:8	5.10	4.07	2.98	3.56	3.35	4.47	4.33	4.09	3.88	3.60
2002/03:9	7.82	4.36	6.03	4.60	4.50	6.48	6.16	6.08	5.74	5.65
2002/03:10	7.44	4.53	5.51	4.74	4.76	6.21	6.02	5.86	5.54	5.34
2002/03:11	6.38	4.57	5.52	4.68	3.94	5.61	5.38	4.98	4.68	4.59
2002/03:12	5.91	4.40	5.43	4.51	4.15	5.32	5.11	4.89	4.60	4.47
2003/04:1	5.22	3.70	5.08	4.11	4.77	4.70	4.56	4.62	4.35	4.41
2003/04:2	5.06	3.97	5.31	4.36	5.04	4.51	4.46	4.51	4.27	4.28
2003/04:3	5.50	3.91	5.25	4.37	4.53	4.44	4.23	4.15	3.92	3.90
2003/04:4	5.65	3.58	5.01	4.13	3.96	4.54	4.28	4.21	3.96	3.96
2003/04:5	4.78	3.51	4.66	3.98	3.15	4.02	3.65	3.35	3.15	3.05
2003/04:6	4.84	3.36	4.71	3.98	2.63	3.55	3.25	3.10	2.85	2.85
2003/04:7	4.62	3.16	4.74	3.81	3.64	3.94	3.53	3.43	3.21	3.19
2003/04:8	4.27	3.30	4.99	3.84	3.63	3.72	3.44	3.31	3.10	3.07
2003/04:9	1.70	3.11	2.15	2.93	1.81	2.34	2.40	2.37	2.17	2.15
2003/04:10	1.31	2.61	2.57	2.53	1.17	1.32	1.37	1.31	1.13	1.07
2003/04:11	1.82	2.59	2.68	2.58	1.11	2.57	3.15	1.69	2.91	1.43
2003/04:12	2.00	2.70	2.74	2.75	1.64	2.33	2.74	1.83	2.56	1.60
2004/05:1	2.35	2.58	2.63	2.60	2.09	2.05	1.97	2.01	1.74	1.81
2004/05:2	2.59	2.34	2.34	2.30	2.06	2.12	1.97	1.98	1.76	1.76
2004/05:3	2.58	2.45	3.13	2.41	2.15	2.45	2.26	2.27	2.03	2.06
2004/05:4	2.65	2.66	3.46	2.63	2.57	2.35	2.41	2.50	2.21	2.30
2004/05:5	3.07	2.60	3.56	2.75	2.46	2.69	2.58	2.52	2.38	2.34
2004/05:6	4.49	2.76	5.21	2.93	3.54	3.32	3.27	3.36	3.09	3.10
2004/05:7	5.54	3.50	6.57	4.48	4.27	4.05	3.85	3.83	3.57	3.63
2004/05:8	5.59	3.71	6.09	4.54	4.67	4.41	4.28	4.29	4.01	4.01
2004/05:9	5.68	3.70	5.96	4.29	3.97	4.22	3.97	3.90	3.72	3.67
2004/05:10	6.23	4.01	6.09	4.51	4.76	5.20	5.03	5.02	4.76	4.75
2004/05:11	6.01	4.00	5.95	4.50	4.03	4.90	4.76	4.64	4.41	4.26
2004/05:12	6.44	4.03	6.08	4.48	4.18	5.36	5.24	5.08	4.86	4.69