Measuring Core Inflation in Bangladesh: The Choice of Alternative Methods

by

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In view of formulating credible monetary policy to attain the price stability objective, the difficult part for the central banks is to distinguish, within ongoing inflation evolutions, between short term volatility and the underlying pressure of inflation. While it has now become a standard practice for most central banks around the world to monitor core inflation, no progress has so far been made in the Bangladesh context. This paper takes a pioneering look in measuring core inflation in Bangladesh focusing on the popular exclusion and trimmed mean approaches. The performance criteria adopted in this analysis show that the measure of core inflation developed in the paper has strong money-induced characteristics and therefore, can credibly be used as a short or medium term guide of monetary policy in Bangladesh.

I. INTRODUCTION

Bangladesh Bank (BB), being the central bank of Bangladesh, is responsible to manage the monetary and credit system of the country in order to foster growth and development. While historically the Central Bank's mandate in Bangladesh has been of a broad nature, a central element has been to conduct monetary policy in order to attain the objective of price stability while supporting sustainable output growth.[1] As such, BB pursues its monetary policy within the framework of

[1] While the original Bangladesh Bank Order of 1972 that provided the founding charter cited (a) price, (b) exchange rate and (c) economic growth and high level of employment

monetary targeting in order to achieve the goal of price stability. By tradition, the price stability objective of BB has been guided by the consumer price index (CPI) inflation. However, focusing on the changes in overall CPI as an operational guide to monetary policy requires qualifications because some volatile and non-trend components of CPI can rob the overall inflation of its credibility as a short or medium term guide to the operation of monetary policy (Berkmen 2002, Bagliano and Morana 2003).[2]

Sources of short-term fluctuations may be some components of CPI that are transitory and easily reversible. These components may be characterised by highly volatile to the supply shocks like climatic conditions (e.g. drought, flood, and monsoon), external trade environment, and other transitory phenomena. Bryan and Cecchetti (1993) argue that transitory fluctuations in the price level caused by non-monetary events, such as sector specific shocks or measurement errors, should not reflect in the policy decisions of the monetary authority as these price changes do not constitute underlying monetary inflation. Hence, general inflation as measured by changes in aggregate price index (e.g. CPI) loses its credibility as a short or medium-run operational guide to monetary policy.

The definition of core inflation is that the long run or persistent component of the measured price that is tied in some way to money growth (Bryan and Cecchetti 1993). However, from the practical efforts in measuring core inflation, there are mainly two sets of definitions: one considers core inflation as a persistent part and the other takes the generalised component of measured inflation (Berkmen 2002, Roger 1998). The Milton Friedman's definition of inflation is "…steady and sustained increase in the general price level" is the basis of definition of core inflation as persistent inflation. Quah and Vahey (1995) have defined the core inflation as the persistent component. The second definition of core inflation by generalised components is the reflection of Arthur Okun's definition as "….a condition of generally rising prices." According to this definition, core inflation is

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among the major goals, the Bangladesh Bank (Amendment Act) 2003 has broaden BB's mandate as the central bank (a) to formulate and implement monetary policy; (b) to formulate and implement intervention policies in the foreign exchange market; (c) to give advise to the Government on the interaction of monetary policy with fiscal and exchange rate policy, on the impact of various policy measures on the economy and to propose legislative measures it considers necessary or appropriate to attain its objectives and perform its functions; (d) to hold and manage the official foreign reserves of Bangladesh; (e) to promote, regulate and ensure a secure and efficient payment system, including the issue of bank notes; (f) to regulate and supervise banking companies and financial institutions.

[2] See Shahiduzzaman (2006) for an example.

that part of measured inflation that is free from relative price disturbances. The notion of relative price movements is often driven by supply side shocks. This is to note that the widely practiced exclusion or statistical measures of core inflation are based on the concept of generalised inflation, where a variety of items of price index that seem to distort the general trend of other prices are removed. In general, core inflation is the steady or persistent component of measured inflation, which is free from the disturbances having only transient impact on inflation. So, core inflation should exhibit more persistence or less variability than the aggregate measured inflation rate (Roger 1998).

The concept of *core* or underlying inflation is thus to separate the persistent part of general inflation, which contains the most relevant information regarding monetary policy operation. Here is the clear departure from the so-called headline inflation based on cost of living index to the core inflation based on monetary phenomena.[3] As for example, inflation that is caused by the non-monetary events such as sector specific shocks or measurement errors can have transitory impact on cost of living, but monetary authorities have little to do with it since these price changes do not constitute underlying monetary inflation. Monetary policy decisions need to be credible, and therefore should not be the subject to quick reversal because of such short-term fluctuations.

In light of these policy considerations, it has now become a standard practice for central banks around the world to monitor the core inflation. As for example, while the Bank of Canada uses the changes in total CPI as the inflation-control target, core inflation is used as a shorter-term operational guide to its monetary policy formulation (Macklem 2001). In the Philippines, the National Statistics Office (NSO) began publishing official core inflation, alongside the CPI general inflation from February 2004. Other countries like Korea, Thailand and United States also routinely publish and monitor core inflation measures.

Thus far, the Bangladesh Bank monitors the 12-month moving average (12 month ma) in defining the underlying trend that averages out the short-term or transitory components in total CPI. However, while the moving average measure tends to reduce the volatility, it affects the timeliness of the data. The average inflation series is dominated by past rather than the current inflation, and hence loses the relevance for the future policy stance of the monetary authority. The point-to-point inflation, which better reflects the current price changes, is highly distorted by the short-term fluctuations limiting its suitability as a short-term

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[3] Wynne (1999) notes that "….for the purpose of monetary policy what is needed is not a microeconomic theory of the cost of living, but a macroeconomic theory of the cost of inflation".

policy guide. Given the context, a suitable measure of core inflation is warranted in the Bangladesh context, which reflects both the current dynamics and underlying trend of inflation.

A common approach in measuring core inflation is the exclusion method.[4] The exclusion method requires taking subjective decision of excluding particular prices from the aggregate price index. Other alternative approaches include statistical and model based approaches. The statistical approach includes the Limited Influence Estimators (LIEs) such as the trimmed mean proposed by Bryan and Cecchetti (1993) and the weighted median. Bryan and Cecchetti (1993) suggested to use of trimmed mean approach if the distribution of the sector specific shocks is skewed. The model-based approach is also called the economic approach that derives a measure of core inflation using the assumption of long-run neutrality of money.

This study employs the exclusion and trimmed mean approaches to construct the core inflation in Bangladesh. The outline of the paper is as follows. Following the introduction in section I, section II reviews the literature on core inflation. Section III postulates the recent movement of prices and their statistical characteristics of price data in Bangladesh, while section IV estimates alternative measures of core inflation using exclusion and trimmed mean approaches. Finally, section V offers the conclusions.

II. REVIEW OF CORE INFLATION MEASURES

There are some common methods of measuring core inflation as found in the literature.[5] These can be broadly categorised under three heads, namely, subjective approaches, e.g. the exclusion method, limited influence estimators, and model-based estimates.

Exclusion method involves omitting some pre-specified components from the CPI basket at all dates that are believed to be highly volatile to supply shocks. A frequently applied approach is to exclude some food and energy prices, popularly known as "ex. food and energy measures." As for example, in the case of United States a typical measure of core inflation is that CPI excluding food and energy (Pedersen 2006) and in the case of Canada, CPI excluding food and energy and the effects of indirect taxes (Hogan, Johnson and Lafleche 2001). In the case of Philippines, the components excluded are *rice, corn, fruits & vegetable, LPG, kerosene and oil, gasoline and diesel* (Guinigundo 2004, Bautista 2005). While

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[4] See, for example, Clark (2001) for United States, Guinigundo (2004) for Philippines, Macklem (2001) for Canada, Samanta (1999) for India and Tahir (2003) for Pakistan.
[5] See Bryan and Cecchetti (1993), Clark (2001), Roger (1998), and Vega and Wynne (2003) for details on different methods.

most countries follow the exclusion method in measuring core inflation, the main criticism of this approach is that not all the components are volatile at every period. Therefore, excluding fixed set of items may lose some information that could be useful for predicting the trend inflation, i.e. part of the trend may be inadvertently thrown out along with volatility.

In order to solve the criticism of a fixed set exclusion, Bryan and Cecchetti (1993) propose the LIEs, e.g. trimmed mean to measure core inflation. The approach attempts to eliminate the temporary noise components by computing limited influence estimators that averages out only central part of a distribution after truncating outlier points. The trimmed mean removes the large relative changes at each month based on statistical criteria. Examining various alternative methods of measuring core inflation, the study postulates that the limited-influence estimators have advantage over other methods as data shows substantial skewness in the distribution of the sample for US for the period of February 1967 to December 1992.

The economic or model based approach proceeds on the assumption of long run neutrality of money. According to this approach, core inflation is that part of measured inflation which has no medium or long run effects on real output. The proponent of the approach is Quah and Vahey (1995), who measure core inflation for UK using the bivariate structural autoregression (VAR) approach. Claus (1997), Gartner and Wehinger (1998) and Bagliano and Morana (2003) extend the model by including some other variables. The main advantage of this approach is that it has a clear economic interpretation. However, as argues by Roger (1998), the approach has limitations to satisfy most of the practical requirement as a measure of core inflation. One is that choices of the variables are at the discretion of modeler and as such different authors have incorporated different type of variables in the model. Given the complexity of the model, the method is not well followed by the central banks.

Berkmen (2002) compares three different core inflation measures, namely, trimmed means, price index excluding food and energy prices, and median inflation for Turkey using monthly data for CPI and WPI from January 1988 to December 2000. While the sample median provides efficient results, the study reveals that trimmed means provide statistically better estimate in terms of cointegration or long run trend of inflation. Cogley (2002) proposes a new measure of core inflation based on the assumption that in the long run inflation is a monetary (or monetary-fiscal) phenomenon and argues that the new measure is adaptive to the changes in monetary policy decisions. Cristadoro *et al.* (2005) offer a new core inflation indicator for the euro area, obtained by "cleaning" monthly price changes from short-run volatility, idiosyncratic, and measurement errors.

Marques, Neves and Sarmento (2003) evaluate the three widely used core inflation indicators for the United States namely, the "excluding food and energy," the trimmed mean and the weighted median and find that both the trimmed mean and the weighted median can be used as useful indicators of core inflation. Tahir (2003) applies exclusion and limited influence estimator approaches to develop measures of core indices for Pakistan and reveals that the trimmed mean method provides a better picture than the traditional exclusion method.

The literature review above suggests that there are also some common methods of measuring core inflation. The exclusion method, which is advocated in several papers and is used as an official measure in many countries of the world, is very simple and easy to compute as compared to trimmed mean or model based estimations. The most important characteristics of the exclusion method are that it is very transparent and easily understandable to the public. However, it poses a major limitation to exclude some components in an arbitrary way that may carry useful information regarding the trend inflation. Several authors suggested the use of trimmed mean approaches (e.g. Bryan and Cecchetti 1993, Bryan, Cecchetti and Wiggins 1997) if the distribution of the sector specific shocks is skewed. Authors who argue for the economic or model based approaches postulate that other methods (e.g. exclusion, trimmed mean) do not have any theoretical or forward-looking characteristics, which the economic approaches possess. Appendix Table 1 summarises some cross-country measures of core inflation.

III. RECENT MOVEMENT OF INFLATION AND THEIR STATISTICAL CHARACTERISTICS

In the last few years, Bangladesh economy faced an increasing inflationary pressure. The rise in inflation has largely been dominated by the food inflation, while the non-food inflation also remained buoyant, especially during 2005-06. CPI inflation as measured by point-to-point basis steadily increased to 10.04 per cent in 2007-08 as compared with 1.7 per cent in 2000-01. Food inflation increased at a faster pace and stood at 14.1 per cent in 2007-08 from only 0.9 per cent in 2000-01, while non-food inflation also increased moderately from 3.1 per cent to 8.3 per cent during 2000-01 to 2006-07 before declining to 3.5 per cent in 2007-08. Therefore, the rise in inflation in Bangladesh in the recent years has become a major concern for the policymakers, especially to that of Bangladesh Bank because high and volatile inflation environment is not conducive to smooth functioning of monetary policy to support the national goals.

Table I presents some descriptive statistics for month-to-month CPI changes (annualised rate) for national, rural and urban for the period of 2001-02 to 2007-08. Mean, median, standard deviation, skewness and kurtosis are reported for

national, rural and urban CPIs. According to the distribution of price changes in a particular fiscal year, the mean value of the monthly changes increased steadily during 2001-02 to 2007-08 at the rural, urban and national levels and gradually increased to highest figures in 2007-08. The median price changes are lower than the mean price changes during 2002-03 to 2004-05 and 2007-08. The standard deviation, which measure the dispersion or spread in the series, is also very high during the period of high inflation. In terms of skewness, the coefficient varies considerably from negative to positive on year to year basis. The kurtosis of the distribution of the price changes is always lower than 3 in all fiscal years at the national and rural levels with considerable variation in the coefficients at national, rural and urban levels. These characteristics imply that mean value would be subject to distortion by extreme price changes and distribution is not normal. It can, therefore, be argued that the mean or average inflation may not be a 'robust' indicator of the persistent inflation in Bangladesh.

TABLE I
**DESCRIPTIVE STATISTICS OF MONTH-TO-MONTH PRICE CHANGES
(ANNUALISED RATE): NATIONAL, RURAL AND URBAN (1995-96=100)**

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
National							
Mean	3.53	4.92	5.5	7.15	7.32	8.9	9.71
Median	4.26	3.58	5.19	7.13	9.71	11.81	7.18
Std. dev.	3.52	3.35	2.82	9.59	9.49	13.9	16.60
Skewness	-1.29	0.65	0.1	0.73	-0.88	-0.65	1.37
Kurtosis	2.42	-1.22	-1.49	2.29	0.49	-0.8	2.51
Rural							
Mean	3.35	5.22	5.55	7.33	7.45	8.85	9.96
Median	4.35	3.48	5.58	7.62	10.88	12.87	7.04
Std. dev.	3.5	3.77	2.92	9.99	9.88	14.37	17.79
Skewness	-1.33	0.65	-0.08	0.58	-1.14	-0.68	1.25
Kurtosis	2.89	-1	-1.42	2.1	1.09	-0.73	2.06
Urban							
Mean	3.96	4.19	5.38	6.71	7.01	9.04	9.09
Median	3.03	3.68	5.11	5.24	6.77	10.34	7.36
Std. dev.	4.36	4.68	3.04	9.28	8.96	13.21	13.75
Skewness	-0.19	0	0.42	0.97	-0.09	-0.74	1.77
Kurtosis	-0.2	1.34	-0.8	1.74	-0.75	-0.07	4.13

Source: Bangladesh Bureau of Statistics.

Figure I portrays the month-to-month CPI changes (annualised rate) and point-to-point inflation rates together with 12-month ma for the consumer prices during

the period of June 2001 to June 2008 for national, rural and urban sectors respectively. It can be observed from the figure that the deviations of the month-to-month and point-to-point inflation rates from the average inflation rates are quite large, and demonstrate quick reversal during the period. These kinds of deviations and quick reversals prove the presence of noise in the price data, a fact that necessitates the development of a suitable measure of core inflation in Bangladesh.

FIGURE 1

MONTHLY INFLATION RATES, 2001:06-2008:06
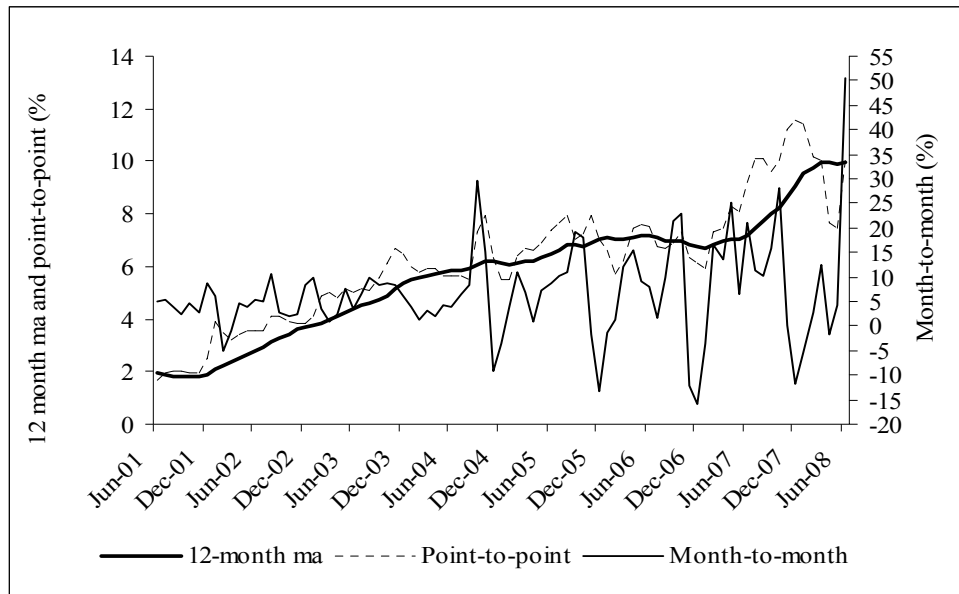
Source: Bangladesh Bureau of Statistics.

IV. ESTIMATING THE CORE INFLATION IN BANGLADESH

Given the debate on the advantages and disadvantages on exclusion and trimmed mean measures of core inflation, this study opts to both approaches to measure the core inflation in Bangladesh based on available data from Bangladesh Bureau of Statistics (BBS). Higher levels of aggregation of all items of CPI to total of 27 components in rural and urban CPIs in Bangladesh for a period of January 2004 to May 2008 are considered for the study. The sample size of the study is constrained by the availability of data from BBS.

IV.1 Estimation of the Core Inflation in Bangladesh Using Exclusion Method

The national CPI (CPI-N) in Bangladesh as released by BBS on monthly basis is a weighted average of rural CPI (CPI-R) and urban CPI (CPI-U), giving 70.89 and 29.11 per cent weight respectively. In constructing the *core CPI* for national the same weighting is applied. Accordingly, separate core indexes are constructed for rural and urban consumers considering the composition of goods and their respective weight before finding the national core measure. As explained above, a very typical example of exclusion method is CPI excluding food and energy. In other cases, core inflation is measured by excluding some volatile items according to set criteria.

The exclusion method targets some components of CPI in an arbitrary way. All sub-groups of food group namely, *rice, other cereal, pulses, fish (fresh) & dry fish, eggs and meat, vegetable, fruits, spices, edible oils and fats, milk and milk products* and *miscellaneous food items*, as well as all sub-groups of some non-food groups namely "*gross rent, fuel and lighting,*" "*transport and communication,*" "*recreation, entertainment and educational services*" and *miscellaneous services* are taken into account. Non-food categories like "*clothing and footwear,*" "*furniture, furnishing, H/H equipment and operation*" and *medical care & health expenses* have been included as broad heads.

In the case of Bangladesh, exclusion of whole food and energy component is made complex by the fact food constitutes a majority share of total CPIs (Appendix Table 2). Thus, excluding the whole food implies ignoring a major share of consumer expenditure. In addition, energy prices are administered and highly subsidised in Bangladesh. Therefore, as the energy prices are periodically adjusted, market prices of energy products are relatively stable at least over the period of non-adjustment. In the case of Bangladesh, it is important therefore to identify specific volatile components, rather than taking all food and energy items as most volatile, in order to measure core inflation.

One additional problem regarding the exclusion method is that the pattern of co-variability among the components of CPI. If the covariance of one volatile component is negative with the remaining components, there is a possibility that the variability of the constructed core index will increase after excluding the component. Some volatile items, as measured by standard deviations of month-to-month changes in prices for the period January 2004 to May 2008, are given in Table II. While most food items appear to be volatile, there are some non-food items that show high volatility. Taking into account the differences in the volatility among different items, a cut-off value of standard deviation is required to set in order to exclude some items for measuring core inflation. In the present exercise,

the cut-off standard deviation is arbitrarily set at 2. Accordingly, items which have standard deviation value of less than 2 in both rural and urban areas have been included in measuring core inflation. Figure 2 shows the core inflation as measured by excluding volatile components (coreXV) which have standard deviation value of higher than 2 and the core inflation excluding food items (coreXF). Unlike the CPI inflation, both of the measures of core inflation show a relatively stable rate of inflation over the period. In the case of volatility based exclusion, about 48 per cent and in the case of exclusion of the food items about 41 per cent of the total CPI commodity basket is retained in the core measure.

TABLE II
VOLATILITY OF CPI COMPONENTS: RURAL AND URBAN, 2004:1-2008:5

Sub-group	Rural		Urban	
	Weight	Standard Deviation	Weight	Standard Deviation
Rice	23.8	2.0	11.3	2.2
Other cereals	2.9	2.8	2.7	2.7
Pulses	1.6	2.3	1.4	2.5
Fish (fresh) and dry fish	9.8	2.9	8.1	2.8
Meat and eggs	3.5	1.1	5.2	1.4
Vegetable	6.1	9.6	4.2	10.5
Fruits	1.2	4.0	1.7	5.0
Spices	3.0	7.3	2.2	8.8
Oil and fats	2.4	1.9	2.5	2.8
Milk and milk products	2.5	1.8	2.6	2.0
Misc. food items	3.6	2.3	2.6	2.5
Beverage	1.0	4.4	2.4	3.1
Tobacco and products	1.5	1.8	1.9	1.6
Clothing and fabrics	6.9	0.3	6.8	0.5
Gross house rent	6.0	0.7	17.2	0.7
Fuel and lighting	8.7	1.7	5.0	1.3
Furniture, furn. H/H eq. and OP	2.7	0.6	2.6	0.7
Medical and health expenses	2.8	0.4	3.0	0.4
Public transport	1.9	0.6	4.7	0.7
Maintenance means of transport	0.8	1.8	1.2	3.0
Miscellaneous services	0.3	2.6	1.2	2.3
Recreation	0.1	1.4	0.5	0.7
Educational expenses	2.7	0.9	5.2	0.9
Radio and musical instruments	0.4	3.2	0.7	1.8
Servant's wages	0.7	0.5	0.9	1.0
Luxury	2.3	1.0	1.8	0.7
Laundry and cleaning	0.8	2.0	0.6	1.2

Source: Bangladesh Bureau of Statistics (BBS).

FIGURE 2

CPI INFLATION VIS-À-VIS CORE INFLATION (EXCLUSION METHOD)
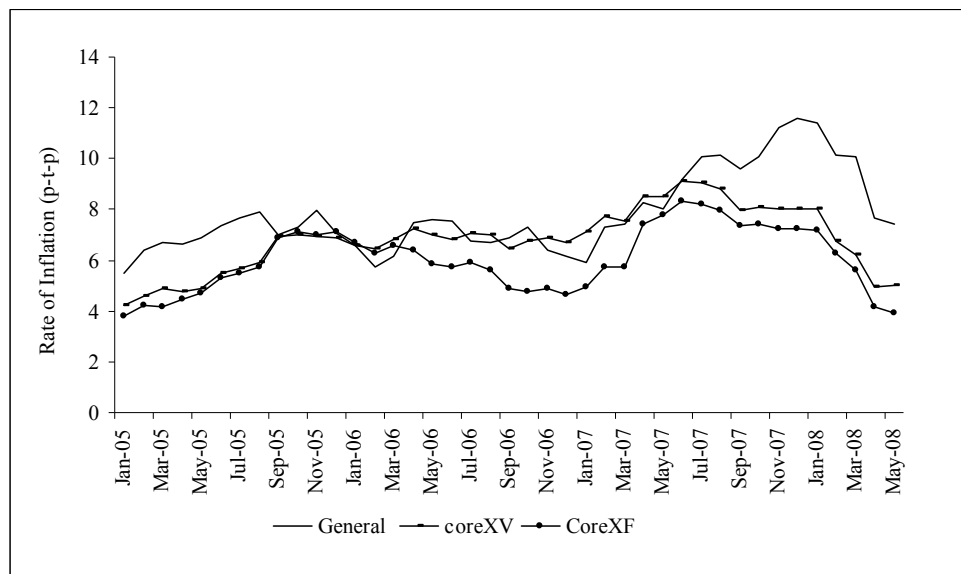
Source: Author's computation using data from BBS

IV.2 Estimation of the Underlying Inflation in Bangladesh Using Trimmed Mean

Although only a few countries have officially adopted the trimmed mean as a measure of core inflation, it has frequently been examined.[6] The main assumption behind the trimmed mean estimation is that volatility of CPI components varies from month-to month, and hence subjective exclusion of some components for the whole series is not appropriate. Given this proposition, the trimmed mean removes the relatively large price changes in each month from the overall CPI for that month.

The use of trimmed mean estimators is particularly recommended if the distribution of the sector specific shocks is skewed (Bryan and Cecchetti 1993). Trimming α-per cent from the tail of the histogram, and then averaging the rest

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[6] Studies include Australia (Kearns 1998), Chile (Pedersen 2006), Ireland (Meyler 1999), New Zealand (Roger 1998), Pakistan (Tahir 2003), Turkey (Berkmen 2002), and United States (Bryan and Cecchetti 1993).

leads to trimmed means. The α-per cent symmetric mean; inflation is determined by

$$\pi_\alpha = \frac{1}{1 - 2(\frac{\alpha}{100})^{i \in I_\alpha}} \sum_{i=I_\alpha} w_i \pi_{it}$$

where π_α are the estimators computed by ordering sorted price change. α is the trimmed mean estimators; if α=0, we obtain the weighted sample mean at α=50, we obtain the weighted median. Note that, the "α" can be asymmetric, in this case, (α_1, α_2)-per cent asymmetric trimming mean is applied.

After trying a number of trims, this study reports three asymmetric trimmed mean measures calculated using α=(0.20, 0.25), α=(0.20, 0.20) and α=(0.10, 0.25) that are found to possess lowest Root Mean Square Error (RMSE). The first one is denoted as core_trim2025, the second one is denoted by core_trim2020 and the third one is denoted by core_trim1025. Figure 3 plots the point-to-point inflation of general inflation and the three trimmed mean measures.

FIGURE 3

POINT-TO-POINT INFLATION: GENERAL VS. TRIMMED MEAN
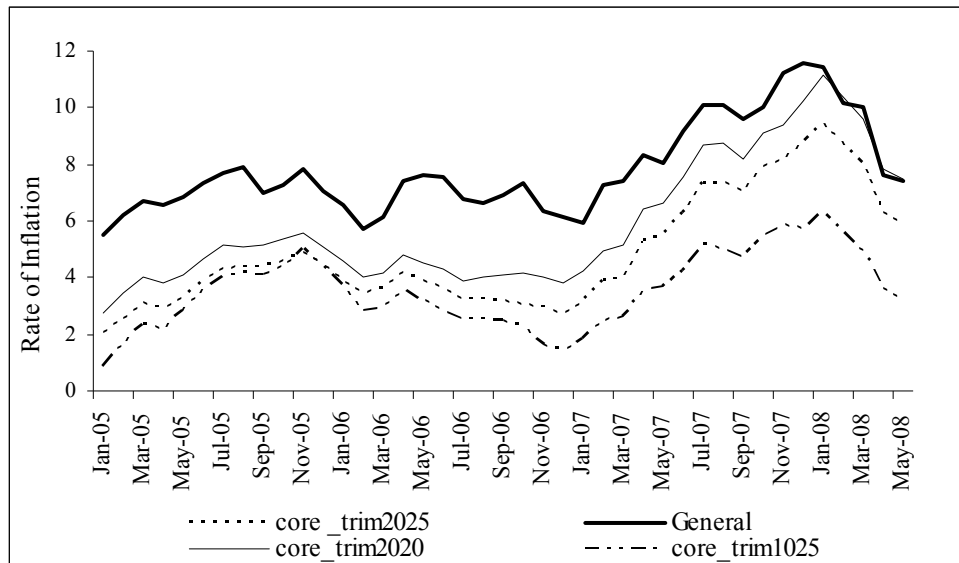
Source: Author's computation using data from BBS.

IV.3 Comparison of Various Measures

There is no well-articulated theoretical framework to evaluate the alternative measures of core inflation. However, most studies evaluate the alternative measures of core inflation on the basis of their ability to track trend inflation in two respects. One is that over a long horizon, the average rate of core inflation should match the general CPI inflation, and the other is that the core inflation will move closely with the trend inflation. Trend inflation is defined in the literature by 12 to 36 months moving average, or by using well-known Hodrick-Prescott filter. In this study, three criteria are set to evaluate the performance of core inflation measures to track trend inflation. Firstly, the mean value of the core inflation should match the average rate of overall inflation for the sample period. Secondly, the standard deviation should be lower, and finally, the core inflation should move closely with the trend rate of inflation as measured by the Root Mean Square Error (RMSE).

The mean and standard deviation for month to month inflation rates of five alternative measures of core inflation are shown in Table III along with general inflation. Among the five core measures, the mean value of coreXV is closest to that of general CPI inflation. In general, the core inflation measures using trimmed mean approach understate the general inflation for most of the period except the rapid rise in the recent months. In terms of the absolute variability, coreXV possesses the lowest standard deviation while the core_trim2025 and core_trim2020 show higher standard deviation than the general CPI inflation. A core measure may be ranked superior if it moves more closely with the trend rate of inflation. In this study, tracking the trend inflation is measured in terms of RMSE. Trend inflation is defined as 36 month moving average of inflation rates. As shown in Table III, coreXV better track the trend inflation among the core measures. The above analysis attests to the superiority of exclusion based approach over the trimmed mean based measures in the case of Bangladesh price data over the sample period examined here.

TABLE III
MEAN AND STANDARD DEVIATION OF MONTHLY INFLATION RATES
(January 2005- May 2008)

	Mean	Std. Dev.	RMSE
General	7.8	1.6	1.7
CoreXV	6.8	1.3	1.1
CoreXF	6.0	1.3	1.4
core_trim2025	4.9	2.0	2.3
core_trim2020	5.9	2.3	1.8
core_trim1025	3.5	1.3	3.2

Figure 4 reveals some interesting patterns of core inflation in Bangladesh, in addition to showing the less variability. First, the core inflation as measured by exclusion method show a declining or remained flat despite general inflation increased at a faster pace during the period. In H1 FY2008, core inflation as measured by exclusion of volatile items displays substantially lower inflation; the core inflation was 8.01 per cent as compared with general inflation 11.59 per cent in December 2007 (Appendix Table 3). As a whole, the difference between core inflation and general inflation has increased in first nine months of FY2008 due to the fact that the latter increased sharply during the period while the former remains relatively stable. Similarly, the movement of underlying inflation in recent past suggests that high general inflation during the period was largely due to raise in the prices of some volatile items like food relative to other prices placing substantial effects of inflation in Bangladesh in the short run. Therefore, central bank should not be worried about this kind of particular shocks to non-core prices as far as monetary policy stance is concerned.

FIGURE 4
TREND INFLATION VIS-À-VIS VARIOUS MEASURES OF CORE INFLATION
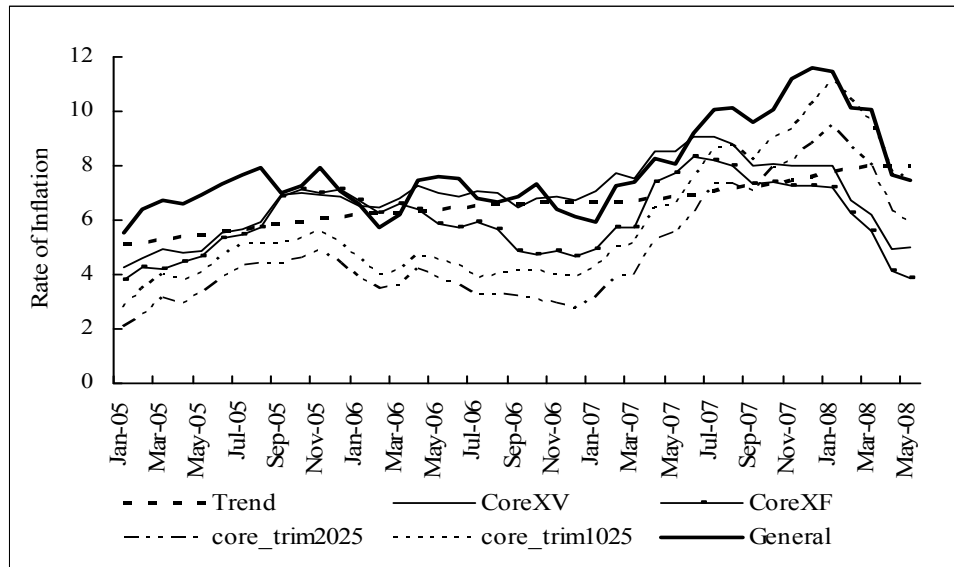
Source: Author's computation using data from BBS.

The concept of underlying inflation suggests that it should be significantly correlated with the money growth. Therefore, it is important to test whether core

inflation is better explained by the money supply in Bangladesh as compared with the general inflation used by BB in formulating monetary policy. Table IV reports the Pearson's correlation coefficients. The table reveals some important information. Firstly, the money growths (point-to-point, 3 months lag) are best correlated with the core inflation than the general inflation measure. The pair wise correlation coefficient between $\Delta M2$ and coreXV is 0.45 and it is highly significant (the probability value is 0.0027). The correlation coefficients between monetary base and general inflation are found comparatively lower and insignificant at 5 per cent level. Secondly, the coefficients between coreXV and growth of monetary bases are found signed correctly, while in the case of general inflation it comes with wrong sign as far as theory of money is concerned. Therefore, it becomes clear that the core inflation measure has the strongest relationship with money growth.

TABLE IV
PEARSON CORRELATION COEFFICIENTS
Prob > |r| under H0: Rho=0

	$\Delta M1$	$\Delta M2$	General	coreXV
$\Delta M1$	1.00			
$\Delta M2$	0.83 (0.0001)	1.00		
General	-0.17 (0.2843)	-0.30 (0.0546)	1.00	
coreXV	0.32 (0.0435)	0.45 (0.0027)	0.57 (0.0001)	1.00

Note: Pearson's Correlation Coefficients are generated by SAS System. Probabilities are presented in the parenthesis. $\Delta M1$ and $\Delta M2$ represent monthly point-to-point growth of narrow money (M1) and broad money (M2). General and coreXV are the monthly national CPI inflation rate and core inflation rate respectively on point-to-point basis. M1 and M2 series are taken as three months lag. The sample period is January 2005 to May 2008.

V. CONCLUDING REMARKS

Both the economic literature and the practice of policy making assign an increasing role to core inflation since it filters out high frequency fluctuations from prices in order to improve the understanding of the short or medium term inflationary pressures on an economy. It is now well practiced in many central banks of the world. Core inflation is now well practiced in the advanced countries

like Canada, United States, etc. and our neighboring countries like Pakistan, Philippines, and Thailand. Recently, Sri Lanka has started to monitor core inflation. However, there is no standard measure of core inflation used either by BB as yet. The 12-month moving average inflation, which BB presently monitors to understand the persistent inflation pressure, is just an average of the point-to-point inflation rates, therefore, ultimately converges towards the latter. In addition, the average inflation series is dominated by the past rather than the current inflation. Therefore, the 12-month moving average inflation, in fact, provides little information about the underlying inflation pressure of the economy. Moreover, in order to make monetary policy credible it is necessary to have inflation definition for BB that possess the money induced characteristics.

In this study, core inflation measures have been derived for the Bangladesh economy using exclusion and trimmed mean approaches. The performance criteria adopted in the study show that the exclusion based approach can better track the trend inflation despite the loss of commodity weights in the process of its computation. In addition, the relative simplicity of the exclusion method may make it more useful to the central bank to communicate it with the common people. It is found that the measure of core inflation developed in this study has strongest relationship with money growth and can be credibly used for the purpose of monetary policy formulation.

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APPENDICES

APPENDIX TABLE 1
MEASURES OF CORE INFLATION USED IN SELECTED COUNTRIES

Country	Measure of Core Measure
Canada	Excludes eight most volatile components from total CPI and then adjusts the remaining components for the effects of indirect taxes
Chile	CPI excluding 20% with higher (-) variations and 8% with higher (+) variations
Colombia	CPI excluding agricultural food, public services, and transport
Germany	CPI excluding indirect taxes
Japan	CPI excluding fresh food
Korea	CPI less energy and non-grain agriculture
Peru	CPI excluding 9 volatile items (food, fruits and vegetables, and urban transport, about 21.2%)
Philippines	Excluding selected food and energy items from headline CPI
Singapore	CPI excluding costs of private road transport and costs of accommodation
Spain	CPI excluding energy and unprocessed food
Thailand	CPI excluding fresh food and energy (23%)
United States	CPI excluding food and energy

Source: Shahiduzzaman (2006).

APPENDIX TABLE 2
WEIGHT AND NUMBER OF COMPONENTS IN CPI-RURAL AND CPI-URBAN

Items and Specification	Rural -CPI		Urban –CPI	
	Weight (in per cent)	No. of Items	Weight (in per cent)	No. of Items
I. Food, beverage and tobacco	62.96	106	48.80	113
A. Food	60.48	99	44.53	104
a. Cereals	26.72	8	13.99	8
i. Rice	23.79	4	11.28	4
ii. Other cereals	2.93	4	2.71	4
b. Pulses	1.61	5	1.42	5
c. Fish (fresh) & dry fish	9.81	14	8.14	12
d. Eggs and meat	3.51	6	5.15	6
e. Vegetable	6.12	23	4.24	24
f. Fruits	1.20	11	1.71	14
g. Spices	2.98	11	2.23	11
h. Edible oils & fats	2.41	4	2.48	4
i. Milk & milk products	2.54	4	2.58	5
k. Misc. food items	3.58	13	2.59	15
B. Beverage	0.96	3	2.40	3
C. Tobacco and products	1.52	4	1.87	6
II. Non-food	37.04	109	51.20	189
A. Clothing and footwear	6.88	33	6.79	48
a. Clothing and fabrics	1.24	6	1.02	12
b. Men's and boy's clothing	2.12	9	1.85	15
c. Lady's and girl's clothing	2.43	13	2.61	11
d. Other household fabrics	0.54	3	0.50	3
e. Footwear	0.55	2	0.81	7
B. Gross rent, fuel & lighting	14.69	6	22.17	13
a. Gross house rent	5.99	2	17.21	7
b. Fuel & lighting	8.70	4	4.96	6
C. Fur. furn. h/h eq. & op.	2.70	28	2.58	37
a. Furniture & fixture	0.75	5	0.71	11
b. Kitchen utensils	0.39	7	0.50	6
c. Household articles	0.32	6	0.30	8
d. Personal effects	0.31	2	0.53	5

(Appendix Table 2 Contd.)

Items and Specification	Rural -CPI		Urban –CPI	
	Weight (in per cent)	No. of Items	Weight (in per cent)	No. of Items
e. Household repairing	0.93	8	0.54	7
D. Med. & health exp.	2.79	5	2.97	16
E. Transport and communication	2.98	11	7.07	22
a. Public transport	1.89	4	4.71	4
b. Maintenance means of transport	0.81	3	1.21	13
c. Miscellaneous services	0.28	4	1.15	5
F. Rec., ent., edu., & cul. ser.	3.20	11	6.40	19
a. Recreation	0.12	2	0.51	10
b. Educational expenses	2.69	7	5.23	7
c. Radio and musical instruments	0.39	2	0.66	2
G. Miscellaneous goods & services	3.80	15	3.22	34
a. Servant's wage	0.69	1	0.85	1
b. Luxury	2.28	9	1.75	20
c. Laundry and cleaning	0.83	5	0.62	13

APPENDIX TABLE 3

**GENERAL INFLATION AND EXCLUSION BASED CORE INFLATION
MEASURES IN BANGLADESH: JANUARY 2005-MAY 2008**

	General	CoreXV	CoreXF
Jan-05	5.5	4.2	3.8
Feb-05	6.4	4.6	4.2
Mar-05	6.7	4.9	4.2
Apr-05	6.6	4.8	4.5
May-05	6.9	4.9	4.7
Jun-05	7.3	5.5	5.3
Jul-05	7.7	5.7	5.5
Aug-05	7.9	5.9	5.7
Sep-05	7.0	6.9	6.9
Oct-05	7.3	7.0	7.1
Nov-05	7.9	6.9	7.0
Dec-05	7.1	6.9	7.1
Jan-06	6.6	6.6	6.7
Feb-06	5.7	6.5	6.3
Mar-06	6.2	6.8	6.6
Apr-06	7.5	7.3	6.4
May-06	7.6	7.0	5.9
Jun-06	7.5	6.8	5.7
Jul-06	6.8	7.1	5.9
Aug-06	6.7	7.0	5.6
Sep-06	6.9	6.5	4.9
Oct-06	7.3	6.8	4.8
Nov-06	6.4	6.9	4.9
Dec-06	6.1	6.7	4.6
Jan-07	5.9	7.1	5.0
Feb-07	7.3	7.7	5.7
Mar-07	7.4	7.5	5.8
Apr-07	8.3	8.5	7.4
May-07	8.1	8.5	7.8
Jun-07	9.2	9.1	8.3
Jul-07	10.1	9.0	8.2
Aug-07	10.1	8.8	8.0
Sep-07	9.6	8.0	7.3
Oct-07	10.1	8.1	7.4

(Appendix Table 3 Contd.)

	General	CoreXV	CoreXF
Nov-07	11.2	8.0	7.3
Dec-07	11.6	8.0	7.3
Jan-08	11.4	8.0	7.2
Feb-08	10.2	6.8	6.3
Mar-08	10.1	6.2	5.6
Apr-08	7.7	4.9	4.2
May-08	7.4	5.0	3.9

Source: BBS and Author's own estimation.

Note: Core XV- core inflation as measured by CPI excluding volatile components; Core
XF-CPI   excluding the food category.