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Estimating Core Inflation in the Maldives

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Abstract

Core inflation measures are widely used by central banks to assess the effectiveness of monetary policy in maintaining price stability. These measures essentially seek to filter out from headline inflation, the distortionary effects of price changes that are non-representative of the general underlying inflation trends. This paper explores the development of core inflation measures for the Maldives. Using the Republic Consumer Price Index (CPI), sampled from June 2012 to December 2022, two of the most widely utilised measures of core inflation—the exclusion-based and trimmed mean measures—were constructed. The performance of these two measures, along with an excluding food and energy (XFE) core inflation measure, were then empirically assessed by evaluating their ability to track the trend of headline inflation, as proxied for by the 24-month centred moving average of headline inflation.

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1. Introduction

Maintaining price stability in the domestic market is both a statutory mandate and a primary objective of the Maldives Monetary Authority. While headline inflation of the Consumer Price Index (CPI) is regarded as the primary signal of price levels and changes thereof, there is some degree of consensus among macroeconomic researchers and central bankers alike, that movements in headline inflation may not always reflect changes in the underlying trends in price levels. This is because headline inflation of the CPI is inherently susceptible to volatility induced by the distortionary effects of transitory, one-off shocks to the prices of individual items in the CPI basket.

The main arguments in favour and defence of this position can be summarised as follows. Firstly, headline inflation has the potential to fluctuate substantially from its general trend level, due to transitory shocks that can affect any given component in the CPI basket. Some examples of such shocks include—but aren't limited to—temporary price hikes in basket items due to increased seasonal demand, supply chain disruptions and/or seasonal scarcity in producer countries and trade partners. Consumer prices in the Maldives tend to be even more susceptible to some of these sources of volatility, given the sparse levels of domestic production and the high degree of import reliance. Secondly, the effects of indirect taxes or changes to government taxation and subsidy policies can also have distortionary, first-round effects on CPI inflation. Historically, such policy-driven changes in price levels have also been a prominent source of volatility in headline inflation in the Maldives.

The issue of headline inflation being non-representative of the general mid-to-long-term price trends has become even more pronounced in the wake of the COVID-19 pandemic, as supply-side constraints and government response policies have resulted in increased volatility in headline inflation, not just in the Maldives, but in many advanced economies including the United States (US) (Ball, Leigh, Mishra & Spilimbergo, 2021). In the Maldives specifically, utility subsidies that were announced as part of the government response package to the pandemic-related lockdowns contributed significantly to substantial deflation of the headline index in both 2020 and 2021. Additionally, significant downward revisions to the per-unit prices of telecommunication services also contributed to deflation and continue to exert downward pressure—at the time of writing—on headline inflation.

For the aforementioned reasons, many inflation-targeting central banks tend to monitor and target various other measures of inflation, in addition to headline inflation, collectively referred to as measures of core inflation. These measures of inflation essentially aim to remove or filter out the distortionary effects of transitory price fluctuations that are non-representative of changes in the mid to long-run trends in inflation.

The objective of this research paper is to estimate appropriate measures of core inflation for the Maldives and empirically assess their performance. To this end, this paper reviews two of the most frequently utilised methodologies that have been used to estimate core inflation in the literature, namely the exclusion-based method and the trimmed mean method. Additionally, the paper also constructs one of the simplest and oldest measures of core inflation, the traditional XFE measure of core inflation, which is essentially a variant of an exclusion-based measure that excludes food and energy prices.

Following this introduction, section two summarises and reviews the literature on core inflation focusing on the two aforementioned methods, and highlighting the main assumptions, methodology, usefulness, and limitations. Section three describes the inflation data used in this paper, outlines the pertinent definitions and also provides a summary of the data and the moments of the cross-sectional distributions of the inflation data over the observation period, June 2013 to December 2022[1]. Section four presents the findings of the estimated core inflation measures and evaluates the statistical efficiency and performance of these measures in terms of their ability to track inflation trends. Lastly, section five summarises the findings and concludes.

2. Review of the literature

As per Wynne (2008), the first appearance of the term 'core inflation' in academic literature goes back to the 1950s when Schreder (1952) used the term without expounding further on it. The term core inflation appears intermittently in the literature in subsequent decades, but all these references share the common characteristics of firstly, having been mentioned tangentially within the context of a related but separate macroeconomic discussion and secondly, lacking a formal, rigorous, definition of the term beyond its mere mention (Sprinkel, 1975; Tobin 1981). The first formal definition of the term can perhaps be attributed to Eckstein (1981) who described it as "the trend rate of increase of the price of aggregate supply" (Wynne, 2008). Gordon (1975) is attributed as one of the seminal pioneers of research on core inflation, having contributed significantly to the development

[1] The Republic Consumer Price Index was sampled from June 2012 – December 2022, therefore the sample for the y-o-y inflation data is from June 2013 – December 2022.

of “Excluding food and energy” (XFE) inflation in the US, in the wake of the oil crisis in the 1970s. Nonetheless, the bulk of the academic research on the notion of core inflation, as it is understood now, commenced post-1990. Bryan and Cecchetti (1994) introduced the notion of core inflation as the component of headline inflation that is solely induced by the growth of the money supply. They posited that core inflation is generally thought of as “the long-run, or persistent, component of the measured price index which is tied in some way to money growth.”

Cechetti (1997) further asserted that while it is relatively straightforward to survey the prices of commodities and construct a price index, it is more complicated to use the CPI to derive a measure of inflation that is suitable for monetary policy decision-making. According to him, headline inflation is potentially unsuitable as an input for monetary policy decisions because of two broad problems, which he describes as noise and bias. Noise, being the transitory component of headline inflation resulting from (among other things) changing seasonal patterns, supply-side shocks, exchange rate volatility and the effects of indirect taxation; while bias is described broadly as errors arising from the way individual components in the CPI are weighted (weighting bias) and biases arising from measurement errors (measurement bias). In his review of Cechetti (1997), Blinder (1997) succinctly describes core inflation as a measure of inflation that focuses on “distinguishing the signal from the noise.”

Despite having been extensively researched in the academic literature, as Mankikar and Paisley (2004) note, there is no single or generally agreed-upon measure of core inflation that performs well across the board for all economies. Generally speaking, the main methods that researchers have used to estimate core inflation fall into the two broad categories of time-series or model-based approaches and cross-sectional approaches, the latter of which uses the cross-sectional distributions of the disaggregated inflation data over a given observation period.

Some of the more commonly utilised time-series approaches include Vector Autoregression (VAR) and Structural Vector Autoregression (SVAR) based methods that build on the seminal work of Quah and Vahey (1995) and Dynamic Factor Index approaches, utilised by Bryan and Cechetti (1993) which were based on the Dynamic Factor Modelling (DFM) techniques developed by Stock and Watson (1991). The cross-sectional approaches that have been used by researchers include exclusion-based methods, exponential smoothing, and trimmed mean methods. This paper focuses on the exclusion-based and trimmed mean methods. The following sub-sections will provide an overview of these two methodologies, underlying assumptions, and their potential usefulness, as well as limitations.

2.1 Trimmed mean method

Trimmed mean methods are utilised and monitored as a measure of core inflation by several central banks and authorities in both advanced and emerging economies. Notable mentions include the trimmed mean Personal Consumption Expenditure (PCE) inflation rate of the Federal Reserve Bank of Dallas and the 16 per cent trimmed mean inflation rate published by the Federal Reserve Bank of Cleveland. Furthermore, in their monetary policy statements many federal central banks such as the Reserve Bank of Australia, Reserve Bank of New Zealand and the Bank of Canada, routinely make references to various trimmed mean and median rates of core inflation that they monitor (Dolmas & Koenig, 2019).

The trimmed mean methods essentially remove outliers from the tails of the cross-sectional distributions of the disaggregated inflation data for each observation period. The principal premise of this method is to trim the mean inflation of each observation period, of the distortionary effects of extreme price changes in that period. After removing these price changes from the tails of the distributions, the weights of the remaining items are then normalised, and the trimmed mean inflation is calculated as the weighted average of the inflation rates of the remaining basket items.

The number of items that are trimmed from the ends of the tails can vary depending on a trim parameter α. For example, a 10% symmetric trimmed mean will trim 5% each from both the lower (left) tail and the upper (right) tails of the distributions. It is important to note, however, that distributions of price changes rarely follow, normal, symmetric distributions and are often skewed in either direction and can often exhibit fat-tails and/or high kurtosis. To account for non-normal and skewed distributions, researchers have explored both symmetric and asymmetric trimming methods and compared their performance in deciding on the optimum trim. For instance, Kim, Kim & Lee (2010) have applied different trimming percentages both symmetrically and asymmetrically to determine an optimum trim in the case of South Korea.

Trimmed mean methods continuously renormalise the weights of the remaining items of the inflation basket on a period-by-period basis, as the trimmed categories will change every month. In the literature, bootstrapping methods are used to determine an optimal trim parameter that minimises the Root Mean Squared Error (RMSE) and Mean Absolute

Deviation (MAD), compared to a benchmark measure for the inflation trend. Various estimates for the inflation trend have been suggested in the literature. This paper follows the 24-month centred moving average of headline inflation which was introduced by Cecchetti (1997) and subsequently used extensively by other researchers as well (Andrade & O'Brien, 2001; Dolmas & Koenig, 2019; Kim et al., 2010; Mio & Higo, 1997).

The key advantage of a trimmed mean measure is that the judgment about the exclusion of an item from the CPI basket is purely based on its tendency to be volatile in a given observation period, rather than a prior decision of permanent exclusion or inclusion. Moreover, Mankikar et al. (2004) have argued that the trimmed mean method allows the incorporation of relative price adjustments of the prior excluded items once it adjusts back to its equilibrium level, or put differently, ceases to be volatile or prone to shocks. They have also highlighted that to determine the potential trimmed fractions it is important to know the sources of price volatility, whether it is caused by the changes in aggregate demand or supply shocks. One of the drawbacks of trimmed mean measures is that the method is relatively more complex compared to the exclusion-based method and therefore may be more difficult to communicate clearly to the public.

2.2 Exclusion-based method

Exclusion-based methods are perhaps one of the most elementary and commonly utilised methods to estimate core inflation. Essentially, this method excludes items from the CPI basket based on their tendency to be persistently volatile or to be prone to frequent, exceptional and/or non-representative price changes that are associated with supply shocks, which monetary policy need not react to (Roger, 1995).

The core inflation measure "Excluding food and energy" (XFE) in the US, is one of the oldest and most well-known examples of an exclusion-based method and variants of this method, where certain items are excluded from the basket, are still commonly monitored and published by central banks and statistical authorities across the world. At the time of writing, the statistical authority of the Maldives, the Maldives Bureau of Statistics currently publishes 15 such analytical exclusion-based series along with their monthly CPI publication, which excludes various CPI items from the basket.

While the essence of the exclusion-based method is to exclude items and then calculate inflation after normalising the weights of the remaining items, it should be noted that researchers have utilised different methodologies to determine the items to be excluded from the CPI. Macklen (2001), in estimating an exclusion-based measure of core inflation in Canada, excluded the eight most volatile items, along with items affected by indirect taxes. In estimating core inflation for Malaysia, Ramli & Rani (2016) excluded a total of 27 items, which accounted for 33.5% of the total CPI weight. They used a combination of statistical approaches (excluding historically volatile items based on variance) and subjective judgement (excluding items whose prices were controlled by the government and items affected by indirect taxes such as alcohol and cigarettes) to determine excluded items. Additionally, one of the more commonly used criteria for exclusion, used by Kim et al. (2010) among others, deems an item to be volatile and thus appropriate for exclusion if the inflation rate for the item exceeds 1.5 times the standard deviation from the mean rate of inflation, in more than 25% of the total observation periods. Compared to many other measures of core inflation, exclusion-based methods have the advantages of being timely, simple, and easily understood by the public. Exclusion-based methods also ensure that the components of the underlying basket and associated weights remain constant over the period (Silver, 2006). The primary drawback of exclusion-based methods centres on the fact that items are excluded permanently based on historical volatility. However, it stands to reason that historical volatility does not necessarily imply that future prices of the item will continue to be volatile in future observation periods as well. Therefore, an excluded item can potentially contain useful information about the general, persistent trend of inflation when it ceases to be volatile.

3. Description of data, definitions and moments of the data

3.1 Description of the CPI data and weighting pattern

This paper uses the Republic CPI dataset for the Maldives, published by the Maldives Bureau of Statistics at a monthly frequency, over the sample period from June 2012 to December 2022. Annual inflation rates are used in the analysis, ensuring a sample period from June 2013 to December 2022. We have utilised the level four disaggregated dataset, which contains a total of 77 sub-components in the basket. Table 1 summarises the weighting pattern of Republic CPI, at the broader level two disaggregation. The level four weights of all 77 subcomponents used in this paper are attached in Table 7 in the appendix.

Table 1: Weighting of the Republic CPI

Level 2 categrories	CPI weights
Food and non-alcoholic beverages	23.49
Food and bev. excl. fish	19.00
Fish and fish products	4.49
Alcoholic beverages, tobacco and narcotics	2.00
Clothing and footwear	3.87
Housing, water electricity, gas, and other fuels	25.81
Furnishing, household equipmentsm and other floor coverings	5.38
Health	5.80
Transport	7.02
Information and communication	9.96
Recreation, sports and culture	1.75
Education services	3.94
Restaurants and accomodation services	5.79
Insurance and financial services	0.08
Personal care, social protection an misc. goods and services	5.10
Total	100.00

3.2 Definitions

The definition of inflation and its moments used in this paper are as per that of Andrade and O'Brien (2001) and is summarised below.

Price changes or inflation rate is defined as:

$$dp_{it}^{k} = \frac{p_{it} - p_{it-k}}{p_{it-k}} \times 100$$

Where dp_{it}^{k} is calculated for component i in the inflation basket of $i = 1,2, \dots m$ categories (where m is 77 in this particular case) over the time horizon k (where k is 12), for the period t. Thus, p_{it} is the index of category i in period t, and p_{it-k} is the index of category i in period $t - 12$, or in other words in the corresponding month of the previous year.

Aggregate inflation is defined as:

$$dp_{t}^{k} = \sum_{i=1}^{m} w_{it}.dp_{it}^{k} = \sum_{i=1}^{m} w_{it}.\frac{p_{it} - p_{it-k}}{p_{it-k}} \times 100$$

Where dp_{t}^{k} is calculated for the whole inflation basket of $i = 1,2, \dots m$ categories, over the time horizon k, for the period t. And, w_{it} is the weight of commodity i in period t. It should be noted that the weights remain constant over time.

Cross-sectional moments of the price changes are calculated as:

$$m_{r}^{k}(t) = \sum_{i=1}^{m} w_{i}.(dp_{it}^{k} - dp_{t}^{k})^{r}$$

And the skewness and kurtosis are calculated respectively as:

$$skew_t^k = \frac{m_3^k(t)}{\left(m_2^k(t)\right)^{3/2}} \tag{4}$$

$$kurt_t^k = \frac{m_4^k(t)}{\left(m_2^k(t)\right)^2} \tag{5}$$

3.3 Moments of the data

This paper considers the k=12, year-on-year inflation rates. When considering the disaggregated inflation data at k=12, the cross-sectional distributions are mostly positively skewed. The 115 cross-sectional distributions, exhibit an average skewness of 1.63. It is also noteworthy that the skewness of the distributions is greater than zero in 97 observation periods (84%) and greater than one in 76 observation periods (66%). The kurtosis for the distributions in 115 observation periods are relatively high, exhibiting a mean of 13.0, and are greater than three in all observation periods without exception. These characteristics of the 3rd and 4th moments indicate that the cross-sectional distributions of the annual inflation data for the Maldives are non-normal, mostly skewed to the right and leptokurtic.

Figure 1: Skewness of the Year-on-Year Inflation, June 2013 - December 2022

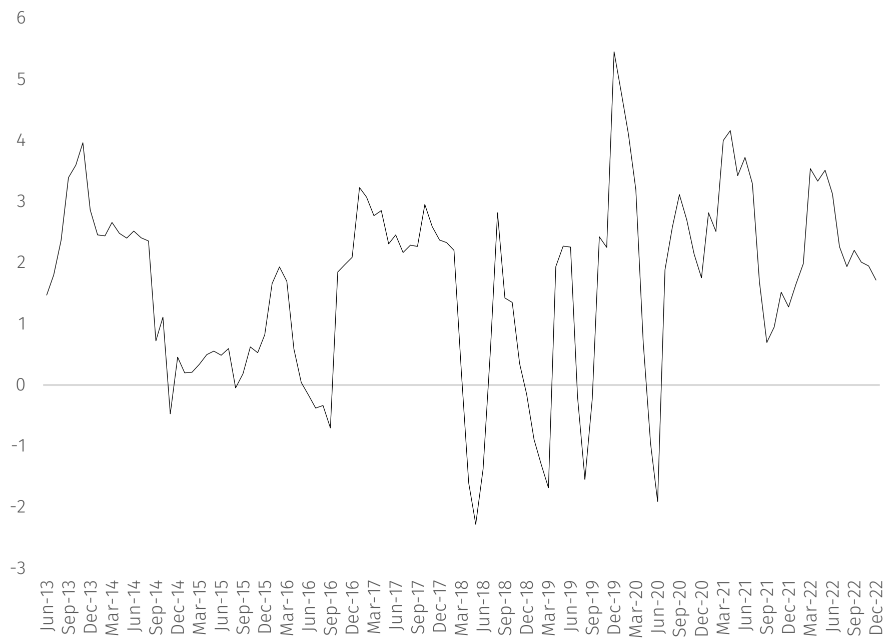
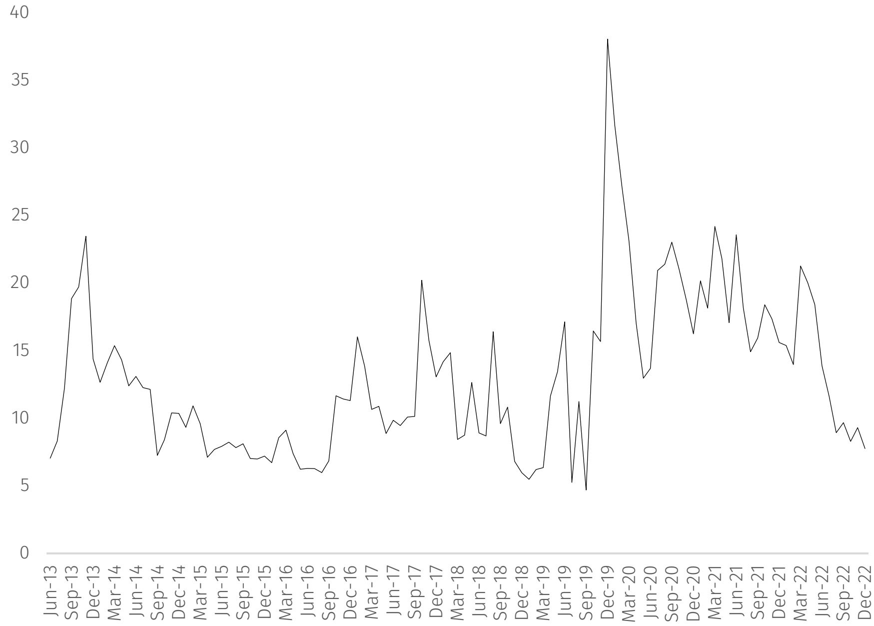


Figure 2: Kurtosis of the Year-on-Year Inflation, June 2013 - December 2022



4. Estimates of core inflation

4.1 Trimmed mean

The trimmed mean method estimates core inflation by excluding a pre-determined fraction from either tail of the CPI distribution. The trimmed mean estimate for core inflation used in this paper adheres to the variation followed by Kim et al. (2010) among others and is estimated using the following steps.

1. Calculate annual inflation (dp_{it}^{12}) for all m categories for each observation period.
2. Sort the inflation data points in ascending order for each observation period. The corresponding weights are also reordered along with the inflation.
3. The trim parameters for α 1-49 are used to trim the tails both symmetrically and asymmetrically.
4. The remaining weights are then renormalised, to sum up to 1, and the trimmed mean is calculated as the weighted average of the remaining inflation points and the corresponding renormalised weights.

5. The optimum trim is then selected based on the trim parameter that minimises the RMSE and MAD when comparing the aggregate inflation associated with the trim parameter compared to the 24-month centred average of headline inflation.

Given the characteristics of the first 4 moments of the distributions discussed in the preceding section, both symmetric (where an equal percentage is trimmed from each tail) and asymmetric (where an uneven percentage is trimmed from either tail, depending on the mean percentile of the distribution) trims were explored.

For asymmetric trimming, the percentile associated with the mean for the observation period is first calculated. Then the trim percentage for the lower (left) tail is calculated as $2\alpha \times$ (the mean percentile) and the trim percentage for the upper (right) tail is calculated as $2\alpha \times (100$ - the mean percentile). Note that the upper tail and lower tail trim percentage would add up to 2α. The trimmed categories are then removed with their respective weights, and the remaining weights are renormalised. It should be noted that the mean percentile was calculated for each observation period and was allowed to vary across time.

For both the symmetric and asymmetric trims, the trimmed mean is then calculated as the weighted average of the remaining inflation data points and their corresponding weights, summarised as follows:

$$\bar{x} = \frac{1}{1 - 2(\alpha/100)} \sum_{i \in I_\alpha} w_{(i)} dp_{(i)} \tag{6}$$

Where I_α represents the set of inflation data points dp_{it}^k, for the untrimmed or remaining items in each observation period and their corresponding weights.

Following standard practice in the literature, bootstrap methods were utilised to determine the optimum trim parameter α that minimises the MAD and RMSE against the 24-month, centred moving average of headline inflation. Table 2 presents the MAD and RMSE for select trim parameters for both the symmetric and asymmetric trims.

Table 2: Optimal Trimming Parameters

α	Symmetric		Asymmetric	
	Sym-MAD	Sym-RMSE	Asym-MAD	Asym-RMSE
1	0.8770	1.0847	1.3829	1.7715
2	0.8972	1.1000	**1.0195**	**1.2596**
3	0.8166	1.0381	1.2050	1.4271
4	0.8648	1.0690	1.2628	1.5177
5	0.8806	1.0801	1.1812	1.4257
6	0.8993	1.1046	1.2174	1.4579
7	0.8341	1.0106	1.2860	1.5571
8	0.8407	1.0221	1.3536	1.6338
9	0.7986	0.9859	1.3299	1.5883
10	0.7721	0.9501	1.2938	1.5304
12	**0.7471**	**0.9136**	1.4078	1.6355
15	0.8434	0.9986	1.5146	1.7273
20	0.9058	1.0960	1.6989	1.9498
25	0.9003	1.1929	1.9269	2.3175
30	0.7646	0.9727	2.3875	2.9983
35	0.8168	1.1591	2.9690	3.7492
40	1.0446	1.6963	4.4666	5.6633

In a symmetric trim, when α=5, a total of 10% (5% from each tail) of the most volatile items are trimmed. In an asymmetric trim, the percentage trimmed from the tails is allowed to vary depending on the percentile associated with the mean of the distribution. To illustrate with an example, when the trim parameter α=5, in an observation period where the mean corresponds to the 30th percentile, 3% would be trimmed from the lower (left) tail and 7% trimmed from the upper (right) tail, with a total trim of 10% of the most volatile items.

As evident from Table 2, despite the asymmetric properties of the cross-sectional distributions of inflation over the observation period, symmetric trimming tends to outperform the corresponding asymmetric trims in terms of the ability to track trend inflation, as proxied for by the 24-month, centred moving average of inflation. When considering the RMSEs the optimum symmetric trim parameter was found to be α=12, which offers an efficiency gain of around 27.5% compared to the optimum asymmetric trim parameter of α=2. The results suggest that the optimum trim is the symmetric trim of 12%, where a total of 24% of the CPI basket are trimmed symmetrically from both tails.

Figure 3: RMSE and MAD for Symmetric Trims, For α = 1 - 49

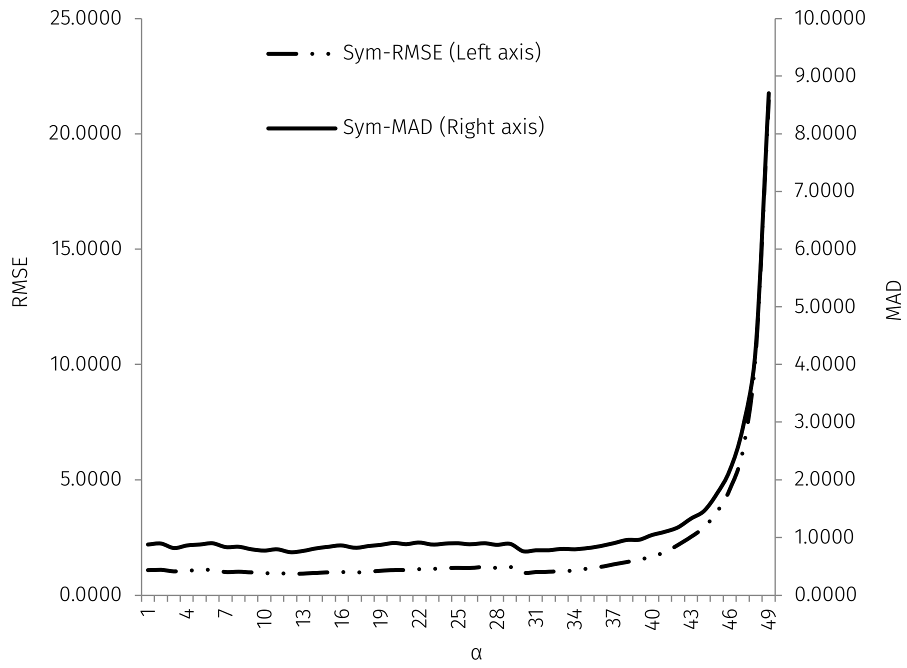
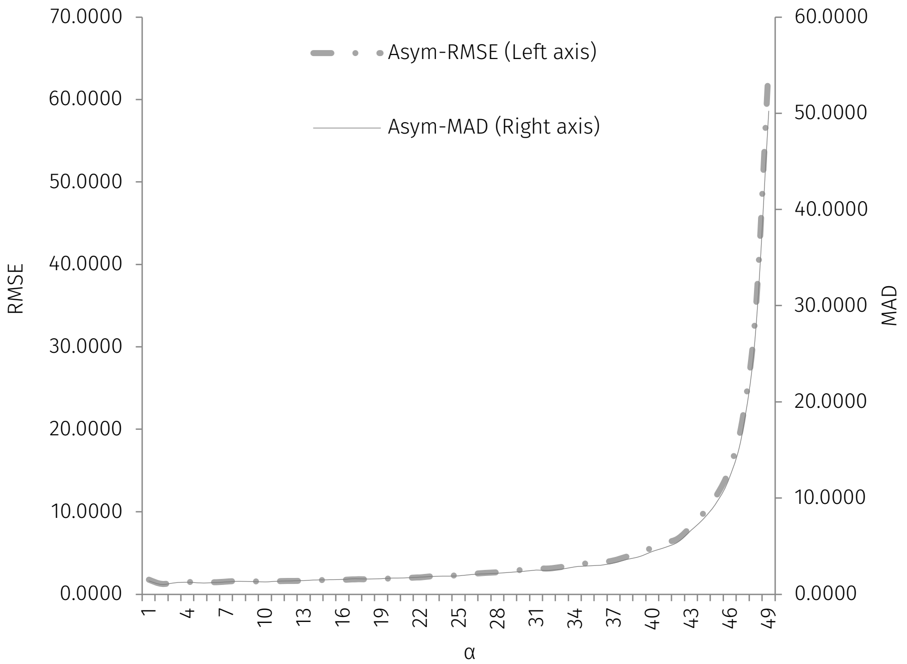


Figure 4: RMSE and MAD for Asymmetric Trims, For α = 1 - 49



4.2 Exclusion-based method

The exclusion-based method estimates core inflation by permanently excluding extremely volatile items from the CPI basket. In this method, items are excluded based on their tendency to be persistently volatile over the observation period. To determine the volatility of specific items this paper adhered to the statistical methodology followed by Kim et al. (2010). This criterion for exclusion (with slight differences), is well-established in the literature and has been utilised by other researchers as well (Macklem, 2001; Silver, 1997). The criteria for exclusion can be summarised as follows:

- Items are deemed eligible for the exclusion if y-o-y inflation rates exceed 1.5 times the standard deviation from mean inflation in a given observation period, for more than 25% of the analysis period.

It should be noted that new items are often introduced into the basket when the CPI is rebased, to improve coverage. For instance, over the horizon of the dataset utilised in this paper (June 2013 to December 2022), inflation data for 23 of the 77 level four items are not available for the period from June 2013 to July 2020. These items were introduced into the basket in August 2019, following the rebasing of the CPI to August 2019 by the Maldives Bureau of Statistics. When considering the eligibility of such items for exclusion, this paper follows the practice of evaluating whether price changes exceed 1.5 times the standard deviation from the mean for each observation period, for more than 25% of the period after which it has been included in the basket, as opposed to the entire analysis period.

Table 3 summarises the volatile items selected for exclusion during the observation period, as per the above criteria. A total of 9 items which together account for 17.3% of the total weight of the CPI are eligible for exclusion. Among these items, the category of *Mobile communication services* is the most frequently eliminated item, (86.2%), whereas the category of *Electricity* (28.7%) is the least qualified. It is interesting to note that there are significant similarities in the complete lists of frequently trimmed and excluded basket items listed in Tables 5 and 6 in the appendix, with 25 items in the CPI basket appearing in both lists.

Table 3: Volatile Items in the CPI

	Weight (%)	Frequency eliminated (%)	Mean inflation (%)	Std. Dev.
Mobile communication services	4.35%	86.2%	-17.22%	4.86
Pets and products for pets	0.13%	69.0%	14.42%	8.20
Fuels and lubricants for personal transport equipment	0.61%	50.4%	0.99%	19.72
Narcotics	0.46%	45.2%	9.22%	12.56
Vegetables	2.58%	42.6%	4.86%	19.69
Other non-alcoholic beverages	0.08%	41.4%	9.76%	9.50
Fruit	3.07%	35.7%	6.30%	9.08
Tobacco	1.54%	31.3%	11.03%	16.80
Electricity	4.47%	28.7%	-4.34%	15.53

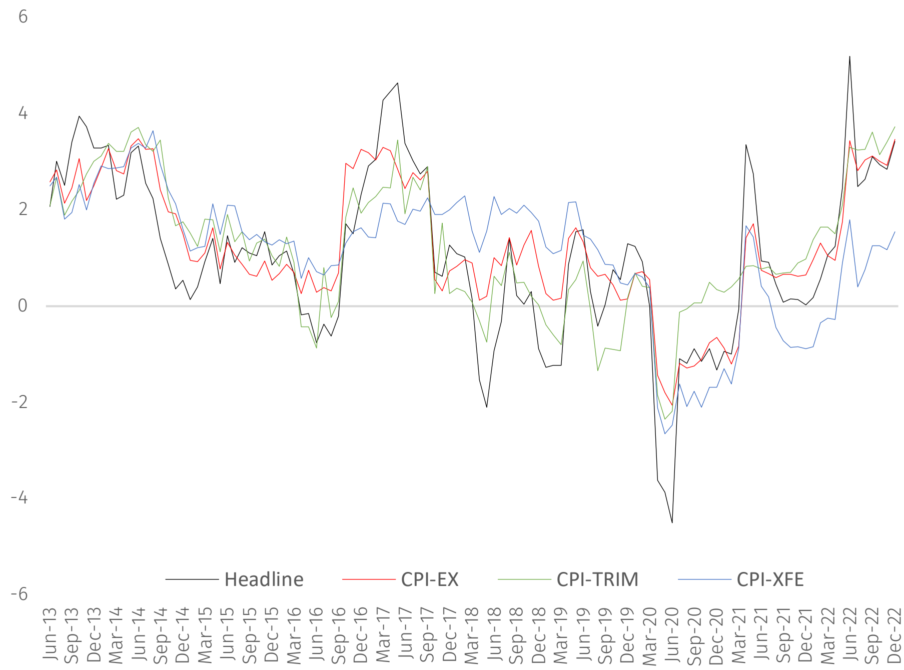
After excluding the above 9 volatile items from headline CPI, the exclusion-based measure of core inflation is calculated as the aggregate inflation (as defined in Section 2) for the remaining items, with their weights renormalised. The resulting exclusion-based core inflation series was also tested for its ability to track the inflation trend using the 24-month centred moving average benchmark utilised in the literature. Table 4 reports the MAD and RMSE stats for the exclusion-based core inflation measure and the XFE core inflation measure, along with those for the optimum symmetric and asymmetric trim measures discussed in the preceding section. The XFE core inflation measure excludes categories of food and energy-related items (fuel and lubricants for personal transport equipment and electricity). This amounts to a total of 17 excluded categories which accounts for around 28.6% of the CPI weights.

Table 4: RMSE and MAD for the Best-performing Measures

	MA24	
	MAD	**RMSE**
Symmetric trimmed mean (α=12)	**0.7471**	**0.9136**
Asymmetric trimmed mean (α=2)	1.0195	1.2596
Exclusion-based	0.8008	0.9468
XFE	1.0386	1.2089

Figure 5: Trimmed Mean, Exclusion-Based, XFE, and Headline Inflation

(annual percentage change)



The results indicate that a symmetric trimmed mean measure with a trim parameter of α=12 outperforms both the other measures reviewed though it must be noted that the efficiency gain over the exclusion-based method is marginal. With a MAD and RMSE at 0.7471 and 0.9136, the trimmed mean method comprehensively outperforms the XFE measure, but compared to the exclusion-based method, offers marginal efficiency gains of around 3.5% when considering the RMSE and around 6.7% when considering the MAD.

These findings are generally in line with recent studies from the US that indicate that trimmed mean inflation measures are found to be less volatile than the conventional exclusion-based measures and the XFE measure in the US, where just as in the Maldives, the post-pandemic dynamics have given rise to a significant amount of supply-side related volatility in headline inflation (Ball, Leigh, Mishra & Spilimbergo, 2021; Dolmas & Koenig, 2019).

5. Conclusion

The objective of this paper was to estimate a core inflation measure for the Maldives using exclusion-based, trimmed mean, and XFE methods. The paper reviewed the usefulness and limitations of these estimates of core inflation and compared the respective abilities of these estimates to track the inflation trend, using the 24-month centred moving average as a benchmark, a practice that has been used extensively in the literature.

Of the different measures reviewed, the results indicate that a symmetric trimmed mean estimate with a trim parameter of 12% outperforms both the exclusion-based and XFE estimates and all other trim parameters for both symmetric and asymmetric trims. While the trimmed mean estimate comprehensively outperforms a traditional XFE measure of inflation, it only offered a marginal efficiency gain over the exclusion-based measure. It is also noteworthy that there was significant overlap and similarities between the most frequently trimmed and excluded categories.

Each measure has merits and limitations. While the exclusion-based measure offers the advantages of being relatively simpler and easier to communicate to the general public, the fact that items are permanently excluded on the grounds of being historically volatile presents itself as a drawback, given that such items can cease to be volatile in future periods and can contain useful information about the inflation signal. The trimmed mean measure is relatively more complicated to communicate to the public but does not suffer from the drawbacks associated with permanent exclusion, as the items that are trimmed from the tails are allowed to vary for each observation period.

Given the relatively marginal efficiency gain of the trimmed mean measure over the exclusion-based measure, it would be useful for the MMA to continue to measure both measures of core inflation. Many central banks opt to use more than one measure of core inflation and future research could also be aimed towards exploring other methodologies to measure of core inflation, with a view towards adopting a range of different measures of core inflation.

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Appendix

Table 5: Most Frequently Trimmed Categories from the Symmetric Trimmed Mean, α=12, June 2013 - December 2022

Category	Frequency Trimmed
Mobile communication services	100.0%
Pets and products for pets	89.7%
Vegetables	71.3%
Fruit	69.6%
Fuels and lubricants for personal transport equipment	67.8%
Mobile telephone equipment	60.0%
Internet access provision services and net storage services	58.6%
Narcotics	56.5%
Equipment for the reception, recording and reproduction of sound and vision	56.5%
Other articles of clothing and clothing accessories	51.3%
Meat	47.8%
Other personal effects n.e.c.	47.8%
Passenger transport by air	46.1%
Electricity	45.2%
Other non-alcoholic beverages	44.8%
Repair, installation and hire of household appliancesS	41.4%
Early childhood and primary education	37.4%
Oils and fats	36.5%
Tobacco	36.5%
Actual rentals paid by tenants for main residence	34.8%
Domestic services and household services	29.6%
Major household appliances, whether electric or not	28.7%
Small household appliances	28.7%
Information processing equipment	28.7%
Cereals and cereal products	26.1%
Sugar, jam, honey, chocolate and confectionery	26.1%
Glassware, tableware and household utensils	26.1%
Other outpatient care services	25.2%
Coffee and coffee substitutes	24.1%
Soft drinks	24.1%
Maintenance and repair of personal transport equipment	23.5%
Fish	22.6%
Food products n.e.c	22.6%
Other information and communication services	22.6%
Passenger transport by road	21.7%
Recreational and sporting services	20.9%
Secondary education	20.0%
Accommodation services	20.0%
Remaining categories	< 20.0%

Table 6: Most Frequently Excluded Categories, June 2013 - December 2022

Category	Frequency Excluded
Mobile communication services	86.2%
Pets and products for pets	69.0%
Fuels and lubricants for personal transport equipment	50.4%
Narcotics	45.2%
Vegetables	42.6%
Other non-alcoholic beverages	41.4%
Fruit	35.7%
Tobacco	31.3%
Electricity	28.7%
Passenger transport by air	24.3%
Sugar, jam, honey, chocolate and confectionery	20.9%
Domestic services and household services	20.9%
Cereals and cereal products	20.0%
Equipment for the reception, recording and reproduction of sound and vision	14.8%
Recreational and sporting services	14.8%
Other outpatient care services	13.9%
Oils and fats	11.3%
Accommodation services	10.4%
Meat	9.6%
Food products n.e.c	9.6%
Hairdressing salons and personal grooming establishments	8.7%
Maintenance and repair of personal transport equipment	7.8%
Other personal effects n.e.c.	7.8%
Coffee and coffee substitutes	6.9%
Soft drinks	6.9%
Furniture, furnishings and loose carpets	6.1%
Passenger transport by road	6.1%
Water supply	5.2%
Remaining categories	< 5.0%

Table 7: Weights of the Level Four Disaggregation of the Republic Consumer Price Index

Category	Weight
Cereals and cereal products	2.67
Meat	1.00
Fish	4.49
Milk, other dairy products and eggs	2.85
Oils and fats	0.40
Fruit	3.07
Vegetables	2.58
Sugar, jam, honey, chocolate and confectionery	1.24
Food products n.e.c	1.81
Fruit and vegetable juices	0.49
Coffee and coffee substitutes	0.49
Tea, maté and other plant products for infusion	1.25
Water	0.90
Soft drinks	0.16
Other non-alcoholic beverages	0.08
Tobacco	1.54
Narcotics	0.46
Clothing materials	0.50
Garments	2.01
Other articles of clothing and clothing accessories	0.15
Cleaning, repair, tailoring and hire of clothing	0.20
Shoes and other footwear	1.00
Actual rentals paid by tenants for main residence	16.79
Security equipment and materials for the maintenance and repair of the dwelling	1.11
Services for the maintenance, repair and security of the dwelling	0.48
Water supply	1.79
Refuse collection	0.34
Electricity	4.47
Gas	0.82
Furniture, furnishings and loose carpets	1.28
Household textiles	0.15
Major household appliances, whether electric or not	1.48
Small household appliances	0.34
Repair, installation and hire of household appliancesS	0.35
Glassware, tableware and household utensils	0.11
Motorized tools and equipment	0.09
Non-motorized tools and miscellaneous accessories	0.11
Non-durable household goods	1.04
Domestic services and household services	0.41
Medicines	0.70
Assistive products	1.02
Outpatient dental services	0.70

Category	Weight
Other outpatient care services	2.26
Inpatient curative and rehabilitative services	0.71
Diagnostic imaging services and medical laboratory services	0.40
Motorcycles	2.31
Bicycles	0.08
Fuels and lubricants for personal transport equipment	0.61
Maintenance and repair of personal transport equipment	0.10
Passenger transport by road	0.82
Passenger transport by air	1.77
Passenger transport by sea and inland waterway	1.32
Mobile telephone equipment	1.80
Information processing equipment	0.40
Equipment for the reception, recording and reproduction of sound and vision	0.37
Mobile communication services	4.35
Internet access provision services and net storage services	1.84
Other information and communication services	1.20
Games, toys and hobbies	0.39
Pets and products for pets	0.13
Recreational and sporting services	0.65
Books	0.20
Stationery and drawing materials	0.38
Early childhood and primary education	0.75
Secondary education	0.12
Tertiary education	0.94
Education not defined by level	2.13
Restaurants, cafés and the like	5.58
Accommodation services	0.21
Insurance connected with health	0.03
Insurance connected with the dwelling	0.03
Insurance connected with transport	0.02
Other appliances, articles and products for personal care	4.37
Hairdressing salons and personal grooming establishments	0.21
Jewellery and watches	0.15
Other personal effects n.e.c.	0.30
Other services	0.08

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