Core Inflation: Measurements and Evaluation

Introduction
Inflation is generally defined as a persistent increase in the price of goods and services over a certain time period. High inflation and expectations about the future course of inflation influence the aggregate spending of households and firms in a way that leads to inefficient allocations of real and financial resources. Such an environment normally results in a sub-optimal growth potential. Hence, price stability, a situation where inflation is relatively low and stable and does not distort economic agents' spending and investment plans, is central to achieving sustainable economic growth. The importance of anchoring inflation expectations and lags in the monetary policy transmission process point to the need for Bank Negara Malaysia to ensure policies on inflation are forward looking. For this reason, in fulfilling its policy mandate to maintain price stability, the Bank looks at different measures and indicators of headline inflation and core inflation. This box article describes the concept of core inflation and discusses how it is being used by the Bank as part of its information set in assessing current and future inflationary trends.

Rationale for Using Core Inflation Measures
In theory, movements in prices are the result of interactions between demand and supply conditions. However, factors that drive demand and supply conditions could differ. In particular, cyclical changes in demand conditions are generally persistent in nature. A change in the price level caused by a variation in demand conditions is most likely to remain for an extended period and represents a permanent change in the underlying inflation trend. By contrast, supply shocks, such as adverse weather conditions or disruptions to global oil production, are usually short-lived and often result in only a temporary deviation of inflation from its underlying trend.

Often, prices of goods and services are determined by the dynamic interaction between demand and supply conditions, which are at times hard to distinguish. An additional challenge to policy analysis is the fact that demand pressures are not directly observable. Measures of core inflation attempt to identify movements in prices that are actuated by demand shocks. To increase the degree of confidence, the Bank employs several methods to compute core inflation. These range from an exclusion-based method to one that is based on statistical techniques. All these methods seek to isolate the persistent component of inflation from transitory price movements. This allows for a better identification of the sources of price pressures.

Measures of Core Inflation
An important measure of core inflation used by the Bank is based on the **exclusion method,** which permanently excludes from the CPI basket, items whose price fluctuations are considered transitory in nature and do not have a lasting impact on the underlying trend in inflation. These include price volatile items such as fresh vegetables and seafood, price administered goods and those that are affected by government price controls. The exclusion-based core inflation series is relatively easy to understand and frequently used by the Bank in assessing the direction of inflation.

While the exclusion-based measure is an important methodology used to estimate core inflation, this is supplemented by other measures such as the **trimmed mean** and **weighted median** methods. Both techniques are based on the distribution of price changes. They place greater emphasis on the general price movements. Small or zero weights are assigned to large price changes that are considered as outliers.

Another method employed by the Bank to estimate core inflation is using the **exponential smoothing technique.** This method derives core inflation by exponentially smoothening current and past aggregate price data. The **double weighted measure,** meanwhile, involves assigning lower weights to highly volatile CPI items and higher weights to items that are less volatile. Instead of removing volatile items, this method seeks to minimise their effects. Yet another alternative way to computing core inflation is by using the **Kalman Filter technique.** It involves extracting a common signal from movements in CPI component. Finally, core inflation could also be derived using **principal**

Table 1
Measures of Core Inflation

Core Inflation Measures	Brief Descriptions	Advantages	Disadvantages
1. Exclusion-based	• Exclude price-volatile energy and food items from the CPI basket • Most commonly used measure among central banks	• Easy to construct and compute • Easy to communicate	• Critics argued that the excluded items may also contain important signals about underlying inflation • Excludes items that could represent a large share of the CPI basket (especially if food and energy account for a large share of CPI)
2. Trimmed mean	• Items are arranged according to the magnitude of their price change during the month • Trims an equal amount (15% for Malaysia) from each end of the distribution of price changes	• Easy to construct and compute	• The exact percentage that is excluded is still subject to debate
3. Weighted median	• Items are arranged according to the magnitude of their price change during the month • Core inflation is selected from the 50th percentile inflation rate at which half of the components in the CPI basket have higher inflation and the other half, less	• Easy to construct and compute • Easy to communicate	• Item with large weights may dominate the median • Median can sometimes differ significantly from the mean
4. Principal component analysis	• Derives core inflation from the common price trends embedded in the various components of the CPI	• Uses disaggregated data from the CPI basket	• The technical nature of the technique reduces its usefulness in communications
5. Exponential smoothing	• Exponential smoothening of current and past CPI data	• Remove seasonality from the data	• Works with some lags • The technical nature of the technique reduces its usefulness in communications
6. Double-weighted measure	• Assigns larger weights to less volatile items and lower weights to the more volatile items	• Easy to construct and understand	• May minimise important price signals from price volatile items
7. Kalman Filter	• Extracts the common price signal that drives price movements in individual CPI components	• Optimal use of the disaggregated CPI data	• The technical nature of the technique reduces its usefulness in communications

component analysis (PCA). Basically, this method identifies patterns in the CPI's main components and expresses them in a way that highlights their similarities.

Each measure of core inflation has its strengths and weaknesses in its success in isolating price changes that are driven by demand-related factors, as opposed to supply-related factors. Table 1 summarises these strengths and weaknesses for the various measures of core inflation.

Uses for Core Inflation
From the policymaker's perspectives, core inflation provides important information not only about current inflation, but also about the future path of headline inflation. Therefore, core inflation analysis is a useful component of the information set used by the Monetary Policy Committee in setting the stance of monetary policy when balancing the risks to price stability and growth. The following two episodes of elevated headline inflation elucidate this point.

February 2006 - March 2007
During this period, headline inflation rose sharply, to average 3.4%, while average core inflation was only 2%. A disaggregation analysis of headline inflation (*see Chart 1*) reveals the increase was mainly the outcome of higher prices for fuel items in the *transport* category of the CPI, following the 30 sen per litre increase in retail fuel prices in February of 2006. The absence of second round effects and subdued core inflation implied that the increase in inflation was almost entirely due to the supply shock and was unlikely to be sustained beyond the near term. As shown in Chart 2, headline inflation did ease off as the supply-side effects began to wane in the second half of 2006.

Chart 1
Disaggregation of factors contributing to Headline Inflation

Note: The disaggregation of factors contributing to inflation is derived from an econometric model for exclusion based core inflation. Price adjustment refers to items excluded from core inflation.

January 2008 – August 2008
During this period, domestic prices, especially for food and energy, rose sharply in response to the higher global prices for crude oil and food commodities. To mitigate the impact of ballooning fuel subsidies on the Government's fiscal position, prices of domestic retail petroleum products were increased significantly in June 2008. While this led to a sharp increase in price administered items in the CPI basket, it also gave rise to a large "knock-on" effect through the supply-chain to other domestic goods and services (*see Chart 1*). Consequently, the underlying inflation rose sharply during the period. In that sense, the rise in core inflation was not reflective of demand pressures but rather the first-round transmission of the fuel price shock across a wide variety of goods and services throughout the economy. With the subsequent reversals of global commodity prices and the downward revisions in domestic retail petroleum products, core inflation began to moderate in the fourth quarter of 2008.

Chart 2
Headline and Weighted Core Inflation

Note: Weights are assigned to the weighted core inflation based on the relative measure of core inflation root mean squared error (RMSE) performance. This technique requires one to regress headline inflation on different core inflation measures at various time horizons. From each regression, one has to calculate the RMSE for the in-sample forecast of the model. The closer the value of the RMSE to 0, the higher weight is assigned to the respective core inflation measure.

Conclusion
The various types of core inflation measures are useful components of the group of indicators used by the Bank to access the incipient risks to price stability. It must, however, be emphasised that no single indicator forms the basis of policy decision. As with all indicators, the interpretation of the core measures has to be within the overall context of the current and expected economic environment.