

## Measuring Core Inflation for Lebanon

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### Abstract

In recent years, food and energy prices have soared boosting inflation rates to highest levels. For developing countries, the weight of these commodities in the Consumer Price Index (CPI) is relatively high and their prices are quite volatile. In this context, this paper presents a new inflation concept for Lebanon measured by the core inflation, which excludes food and energy prices, and is considered as a complementary indicator to the headline inflation. The current study lays out the results of two main statistical approaches suggested to compute Lebanese core inflation: the exclusion method and the volatility-weighted method. Accordingly, the concept and measurement of 'core inflation' could be a useful monetary policy tool and has to be reconsidered by policymakers when monitoring inflation rates.

Key Words: commodity prices volatility, exclusion-based measure, monetary policy, volatility-weighted measure.

### 1. Introduction

In both inflation and non-inflation targeting countries, Central Banks should review and analyze inflation measures to achieve their price stability's goal, particularly in recent years where food and energy prices have surged boosting inflation rates to highest levels. Consequently, the concept of 'core inflation' (defined as the rate of change in the CPI that excludes the more volatile items such as food and energy prices) could be a good indicator of the underlying inflation trend and a useful guide for monetary policy. As temporary price fluctuations are often caused by non-monetary forces such as shocks in agriculture food supply or change in international oil prices, core inflation is more controllable than headline inflation, and is often used as an implicit monetary policy target. Thus, many Central Banks use core inflation as a complement measure of headline inflation to correctly interpret and react, if necessary, to monthly movements in aggregate prices.

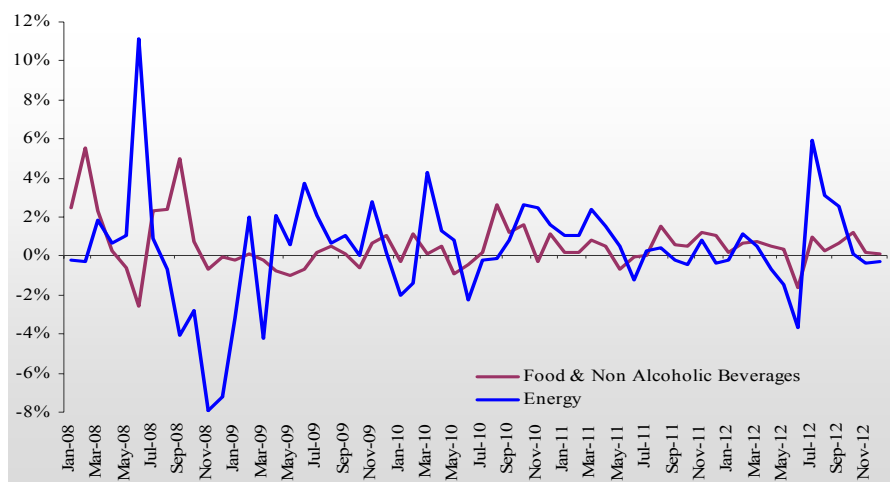
This paper highlights, in its first part, the contribution of food and energy items in the Lebanese CPI and their volatility over the last five years. In the second part, it lays out the results of two main approaches suggested to compute the core inflation for Lebanon: the exclusion-based measure and the volatility-weighted method.

### 2. Food and energy contributions in the CPI and their volatility over the last 5 years

By definition, headline inflation refers to the rate of change in the CPI. It is about the changes in the cost of living based on the movements of the prices of items in the basket of commodities and services consumed by households. It is caused mainly by demand pressure, cost of production or increase in money supply.

Using this inflation rate in monetary policy analysis is sometimes misleading due to the volatility of certain components included in the CPI. For instance, the prices of fruits, vegetables, gasoline, fuel, oil and natural gas are extremely volatile (due to their particular market), are affected by world prices and are sensitive to exchange rates. Moreover, the Demand for such goods with no close substitutes (such as food, water and electricity) tends to be inelastic; when the prices increase, demand for necessities remains almost the same. Therefore shifts in food or energy supply can cause relatively big changes in prices, and consequently in aggregate inflation.

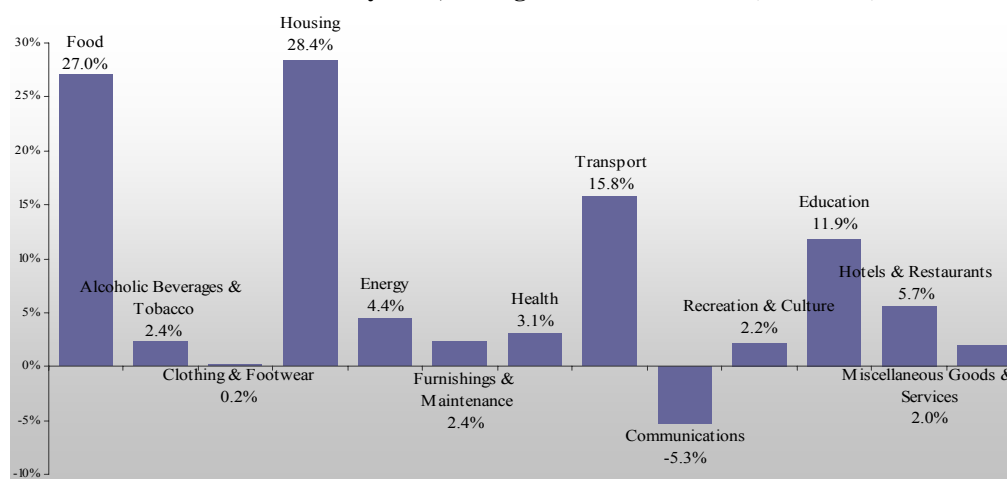
**Chart 1. Volatility of Food and Energy Prices (monthly changes)**



Source: CAS and own calculations

Over the last five years, food prices fluctuations showed an unprecedented peak level in food prices reaching 39.2% in 2008 compared to 2007. While there was a significant drop to -8.5% in 2009, prices rose again in mid-2011, and remained relatively high till end-2012. Since energy costs have a strong impact on food prices, energy prices followed the same trend over the past years with a significant peak in 2008, where the price of crude petroleum grew by 36.4% compared to 2007 and then dropped to -36.3% in 2009<sup>1</sup>. Since Lebanon imports consecutively more than 80% and 90% of the food and energy it consumes, it is highly exposed to international food fluctuations. An international food crisis could severely affect Lebanon and any global price shifts will be reflected in local food and energy inflation. This high pass-through of international food and energy prices can be observed in chart 1 where price volatility is clearly reproduced over the period 2008-2012, in particular the peak in local food and energy prices due to the international food crises in 2008.

**Chart 2. Inflation by Item, average contribution in % (2008-2012)**



Source: CAS adjusted series and own calculations

<sup>1</sup> Source: UNCTAD, Commodity Price Statistics Online and United Nations Statistics Divisions (UNSD).

On the other hand, during the same period, the main items contributing the most to inflation in Lebanon were housing, food and non-alcoholic beverages, and transport and energy, with an average contribution of 28.4%, 27.0% and 20.2% respectively (Chart 2).

It is worth noting that housing was the main factor that triggered inflation up during the previous five years. In fact, Lebanon witnessed a boom in the Lebanese real estate sector since 2008. As this item has remained unchanged according to the CAS statistics from July 2010 till June 2012, the Banque du Liban adjusted the series by orderly distributing the sudden increase noted in July 2012 across the three previous years.

Since food and energy prices are quite volatile and their contribution in the inflation process during the past years was significant, it is highly recommended to take both factors into consideration while analyzing the underlying inflation in Lebanon.

### 3. Statistical approaches to measure core inflation

In the literature, there are several methods used to compute core inflation (trimmed mean, principal component analysis, volatility weights, and variable exclusion approaches). In our study, we chose two approaches: the exclusion and the volatility-weighted method. The exclusion method is the most common approach which computes core inflation by excluding the prices of some components considered to be either volatile or sensitive to supply disturbances. In the volatility-weighted method, also known by inverted weight approach, the most volatile components are given the lowest weight.

#### 3.1. Exclusion-based measure

In this approach, we have to identify components in headline index that are to be excluded. Components that presented the highest volatilities were candidates for exclusion.

Accordingly, we constructed the following three core inflation measures:

<u>Core-CPI1</u>	<u>Core-CPI2</u>	<u>Core-CPI3</u>
<ul style="list-style-type: none"> <li>- CPI excluding bread, grains, vegetables, fruits, meat, mineral water, soft drinks and juice items (19.9% of the CPI)</li> <li>- Represents 80.1% from the total CPI</li> </ul>	<ul style="list-style-type: none"> <li>- CPI excluding water, electricity, gas and other fuels (9.5% of the CPI)</li> <li>- Represents 90.5% from the total CPI</li> </ul>	<ul style="list-style-type: none"> <li>- CPI excluding both food and energy items (29.4% of the CPI)</li> <li>- Represents 70.6% from the total CPI</li> </ul>

In order to construct these three core CPI indexes, we considered the Laspeyres price index used to calculate the CPI:

$$P_t = \frac{\sum_{i=1}^n q_{i0} p_{it}}{\sum_{i=1}^n q_{i0} p_{i0}} \times 100; \quad \text{taking } w_i = \frac{q_{i0} p_{i0}}{\sum_{i=1}^n q_{i0} p_{i0}} \Rightarrow \quad P_t = \sum_{i=1}^n w_i \frac{P_{it}}{P_{i0}} \times 100$$

$P_t$  stands for the CPI,  $q_{i0}$  and  $p_{i0}$  are consequently the base period quantity and price of good  $i$  and  $P_{it}$  is the price of good  $i$  at time  $t$ .

The exclusion core measure is defined as a subset of the aggregate index basket. The new core price level includes goods 1 to  $n$ , and excludes goods  $m + 1$  to  $n$ .

$$P_t^{core} = \frac{\sum_{i=1}^m w_i \frac{P_{it}}{P_{i0}} \times 100}{\sum_{i=1}^m w_i} \quad \text{where } m \leq n$$

The denominator rescales the weights ( $w_i$ ) for goods 1 to  $m$ , and goods  $m + 1$  to  $n$  are re-assigned to have zero weights. Therefore the new weights for the remaining components after exclusion are presented in the following table.

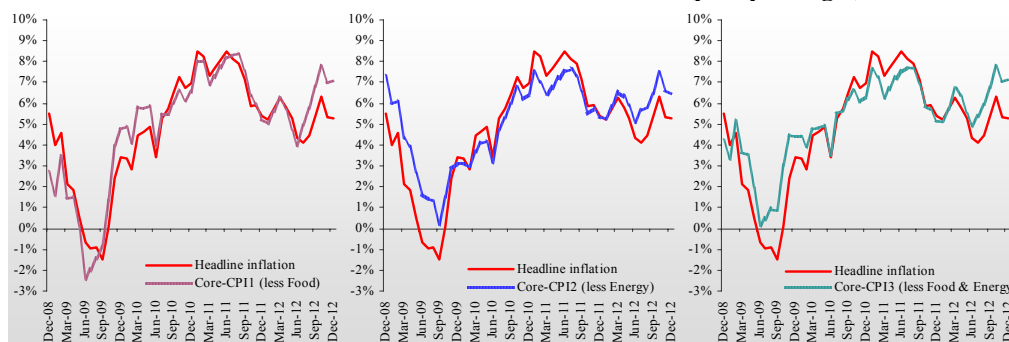
**CPI and its components: Re-weights after exclusion**

	Weights	Less Food	Less Energy	Less Energy & Food
<b>CPI Components</b>	<b>100.0%</b>	<b>80.1%</b>	<b>90.5%</b>	<b>70.6%</b>
Food & non-alcoholic beverages	19.9%	0.0%	22.0%	0.0%
Alcoholic beverages, tobacco	2.1%	2.6%	2.3%	3.0%
Clothing & footwear	6.2%	7.7%	6.9%	8.8%
Housing	16.2%	20.2%	17.9%	23.0%
Water, electricity, gas and other fuels	9.5%	11.9%	0.0%	0.0%
Furnishings, household equipment & routine maintenance	3.9%	4.9%	4.3%	5.5%
Health	6.8%	8.5%	7.5%	9.6%
Transportation	12.3%	15.4%	13.6%	17.4%
Communication	4.8%	6.0%	5.3%	6.8%
Recreation, amusement & culture	3.7%	4.6%	4.1%	5.2%
Education	7.7%	9.6%	8.5%	10.9%
Restaurant & hotel	2.7%	3.4%	3.0%	3.8%
Miscellaneous goods & services	4.2%	5.2%	4.6%	6.0%

Source: CAS adjusted series and own calculations

Headline inflation and different measures of core inflation computed on a year-on-year basis, are presented in Chart 3 where we can observe a counteracting forcing over inflation during some periods from 2009 to 2012.

**Chart 3. Headline and Core Inflation Measures (yearly changes)**



Source: CAS adjusted series and own calculations

The first nine months of the year 2009 was marked by a disinflation process. In this period, food prices pushed inflation up by 0.1% (food prices remained high after their peak in 2008) while energy prices pushed inflation down by 3.1%. If both energy and food prices were excluded, the inflation would decrease by 2.2%; showing that the decline in energy prices would be the main factor that hindered the inflation's rate. In May 2010, headline and core inflation rates excluding food and energy were about the same and the two curves coincided at this point (4.9%). Between July 2010 and July 2011, both headline and core inflation grew in parallel and soared to reach their highest level in January and June 2011 (8.5% headline inflation vs. 7.6% core inflation excluding

food and energy). Therefore, headline inflation was bolstered by 0.9% more than the core rate, due mainly to the high levels of fuel costs during the first half of 2011. Sharp rises (the barrel of oil reached USD 125 in April 2011) were largely due to political unrest in oil-producing countries in the Middle East and North Africa. Food and energy prices did not have significant effect on headline inflation over the second half of 2011, where headline and core inflation rates were very close; their deviation has been accentuated since July 2012. In December 2012, both food and energy prices lessened pushing inflation down by 1.9% (which is the highest gap between headline and core inflation excluding food and energy since end-2009).

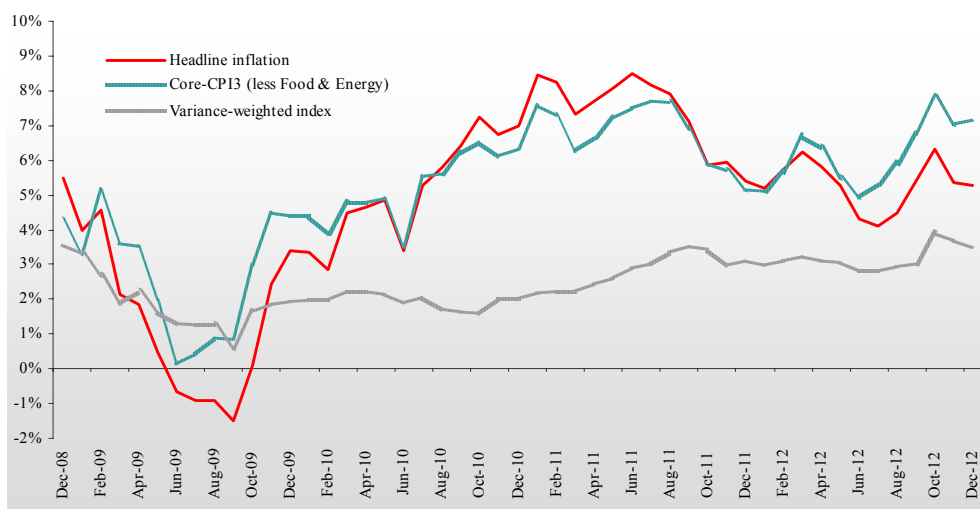
**3.1. Volatility-weighted or Inverted weight method**

In contrast to the exclusion approach, in this method all components in the CPI are retained. We assumed that a component’s signal for the general price trend will decrease as its relative price variability increases. In this method, lower importance is assigned to volatile components, while components that fluctuate less are given a greater weight (Dow and Diewert, 1995). Weights for the various individual prices are inversely proportional to the volatility of those prices (more variance, less weight):

$$\text{Variance-weighted index} = \frac{\sum \frac{1}{\sigma^2} \times \pi_i}{\sum \frac{1}{\sigma^2}}$$

Where  $\pi_i$  stands for the year-on-year inflation rate of components  $i$  in period  $t$ ,  $\sigma^2$  is the estimated variability in each component and the weight of each component is defined as the inverse of the variance (or the standard deviation square) of each component:  $1/\sigma^2$ . This measure weights observed inflation in each item by the reciprocal of its volatility, so that more volatile items, which may give less informative signal about underlying inflation are given smaller weights. For instance, the energy component with the highest standard deviation ( $\sigma=10.0$ ) is given the less weight while the miscellaneous item with the lowest standard deviation ( $\sigma=1.23$ ) is given the highest weight when computing the core index based on this method. It is important to stress that our sample period is relatively short to this approach which requires longer series to have more accurate results.

**Chart 4. Core-CPI3 vs. Variance-weighted index (yearly changes)**



Source: CAS adjusted series and own calculations

Over the period 2009-2012, Lebanese Core Inflation rate (excluding food and energy) averaged 5.2% reaching an all time high of 7.8% in July 2011, and a low of 0.1% in June 2009. The variance-weighted index averaged only 2.4% with a high of 3.9% in October 2012 and a low of 0.6% in September 2009. Headline inflation averaged 4.8% reaching a peak of 8.5% in June 2011 and a drop of -1.5% in September 2009 (Chart 4).

By comparing the variance-weighted index with the core-CPI3 based on exclusion method, we notice the smoothness of the curve compared to the other conventional ex-food and energy core measures. The inflation trend is nearly the same but the gap between headline inflation rates and core measures based on the exclusion approach is smaller than the gap between overall inflation and the variance-weighted index.

Unlike the exclusion method, this approach has the advantage of ensuring that no information, that might contain important indications of the price trend, is lost when calculating the core inflation index. However, the exclusion method remains the most popular approach applied by many central banks due to its simplicity in computing and its transparency to public. Thus, by applying this method, Lebanese core inflation rates could be compared with other core measures knowing that exclusions depend on the country's specific conditions and differ from advanced to developing countries.

#### **4. Conclusion**

In conclusion, the different core inflation measures proposed in this study provides innovative means and relevant information by which policy makers can separate short run fluctuations from more persistent components of the CPI when monitoring the Lebanese inflation. However, in both approaches, we should remain vigilant against permanent increases in core inflation and need to respond to second-round effects. The latter refer to the indirect impact of the increase in commodity prices on other prices, through cost or demand pressures.

As a matter of fact, inflation pressures could emerge due the wage-price spiral and authorities should take action if second-round effects begin to appear. Moreover, underlying inflation is not only a good indicator of second-round effects but could be considered also as a good predictor of future headline inflation.

Finally, our empirical findings suggest finally two guidelines for future research. First, the exclusion method requires further development as to exclude the most volatile items under food and energy categories. Second, it would be crucial to test the leading nature of core inflation especially in the light of the recent debate on whether Central Banks should rely on headline or core inflation to predict medium-term inflation.

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