Abstract

Communicating on Lebanese inflation:
Deciphering the impact of imported inflation
By Sana Souaid Jad, PhD
Banque du Liban, Beirut, Lebanon
sjad@bdl.gov.lb
The main purpose of this paper is to estimate the importance of imported inflation in the total headline inflation computed using the Consumer Price Index for the Lebanese economy. For decision-makers, it is crucial to disentangle the effect of foreign exogenous factors from domestic ones on headline inflation in order to conduct the monetary policy optimally.
Since Lebanon's consumption is mainly based on imports and highly exposed to international price fluctuations, imported inflation plays a prominent role and its amplitude should be measured.
Two different approaches have been followed to estimate the share of imported inflation: a sectorial approach and a model estimation. In the first approach, we use the structure of the Lebanese Consumer Price Index (contribution of each component in the final CPI basket) in order to evaluate the share of variation due to the externally driven items. In this context and given the big share of imported volatile items such as food and energy and their significant contribution in the inflation process, a closer analysis between headline and core inflation is performed.
In the second approach, we estimate an econometric model[1] where changes in CPI originate from domestic factors (money supply, interest rates) and external ones (Brent price, effective exchange rate[2]). The share of inflation volatility due to external factors is computed and compared to the results found in the first approach.
As expected, both approaches show that imported inflation plays a major role in headline inflation since it accounts for 50% of the total volatility of headline inflation as per approach 1 and around 40% based on approach 2. These results prove that Lebanon is quite vulnerable to external shocks which can have significant repercussions on the monetary policy of the country.
Keywords: headline inflation, core inflation, imports, exchange rates, Brent prices.

I- Introduction

The relationship between imports and inflation has been the subject of many studies. It is clear that a major part of inflation fluctuations arises from external factors which cannot be controlled by the local monetary authority. Consequently, policymakers need to assess the true impact of their actions on the inflation level and estimate the volatility caused by external shocks. This has led monetary authorities and academics to define core inflation as a new measure of inflation in which the influence of external and highly volatile factors has been reduced (ideally removed). Such instrument enables policymakers to isolate and target the structural and controllable[3] factors behind inflation. In other words, it captures the component of price change that is common to all domestic items and excludes components that are subject to frequent and temporary price shocks (such as food and energy prices).
This paper aims to analyze both headline and core inflation in the Lebanese economy, and helps identify to what extent the Lebanese headline inflation is affected by domestic factors and imported inflation.
The next section describes the methodology which has been followed to measure imported inflation: two stand-alone approaches, namely a sectorial empirical approach and an econometrical one, are used to estimate the share of imported inflation in headline inflation. By adopting these two distinct approaches, we are able to perform a robustness check to the overall study. The following section presents the results of our approaches while the last section concludes the study and provides us some final remarks.

I- Methodology

a- Sectoral approach

The first approach is based on the way the Consumer Price Index (CPI) is built: a choice of items which are highly-dependent on external factors is performed and allows to assess their impact on CPI and to build a core CPI measure (by removing these items). For the sake of completeness, a brief review of how the CPI is computed can be found hereafter.

[1] Based on the BDL Statistics and Economic Research Department's current inflation model.
[2] The Lebanese Pound is pegged to the US Dollar meaning that fluctuations in the EER are essentially due to variations in the USD/EUR exchange rate (EU is the main trading partner of Lebanon). Thus, a shock on EER can be considered completely exogenous to the Lebanese economy.
[3] Through expansionary or contractionary monetary policies.

The CPI is an index of the cost, through time, of a fixed market basket of goods and services purchased by a typical household for consumption in some base period. The composition of the Lebanese basket is derived from a detailed expenditure survey conducted by the Central Administration of Statistics at the level of households and individuals. The CPI is computed by applying the Laspeyres index which uses historical quantities (weights):

$$P_t = \frac{\sum_{i=1}^{n} q_{i0} p_{it}}{\sum_{i=1}^{n} q_{i0} p_{i0}} \times 100$$

q_{i0} is the base period quantity of good i
p_{i0} is the base period price of good i
p_{it} is the time t price of good i

Where each subindex i is related to a given item of the basket. The choice of weights q_i is fixed and changes to CPI occur through changes in the price levels p_i. Headline inflation refers to the rate of change in the CPI. It captures the changes in the cost of living based on prices fluctuations of items in the basket of commodities and services consumed by households. However, using the headline inflation rate for monetary policy analysis is sometimes misleading due to the volatility of certain components included in the CPI. The current composition of the CPI basket and the weight for each one of the items can be found in the following figure.

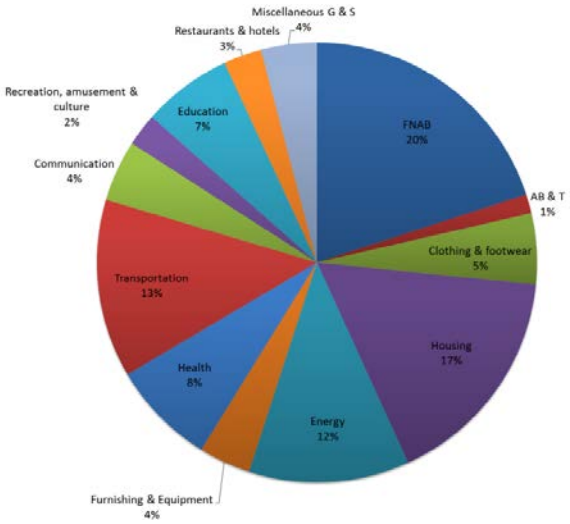

Figure 1: composition of CPI
Source: CAS

Based on the previous formula, we can compute the volatility of CPI due to each of sectorial items. Two factors come into play in determining the impact of each item:

- **Weight**: the higher the weight of the item in the CPI formula, the more impact it will have on headline CPI
- **Volatility of prices per sector:** the higher the variations of prices in a given sector (compared to other sectors), the higher the influence of this sector on headline CPI

The influence of each component on the headline inflation is simply the product of its weight by its year-on-year change. The link between imported inflation and this approach comes from the fact that prices in some of the sectors are exclusively determined by the outside world, such sectors include energy and food items. Consequently, a first assessment of the impact of imported inflation can be made by computing the share of volatility in CPI due to these components.
Furthermore, an alternative for constructing a core CPI measure is to exclude the "external" items from headline CPI and re-weight the remaining items on a prorata basis (exclusion method).The new core price level includes goods 1 to *m*, and fully excludes goods *m*+1 to *n*. The denominator rescales the weights for commodities 1 to m and commodities m+1 to n are re-assigned to have weights zero.

$$P_t^{core} = \frac{\sum_{i=1}^{m} w_i \frac{p_{it}}{p_{io}} \times 100}{\sum_{i=1}^{m} w_i}$$

Where $m \leq n$

Several other methods are used to compute core inflation: Trimmed mean, principal component analysis, volatility weights, and permanent and variable exclusion approaches[4].The exclusion method is the most common approach (used by several Central Banks) due to its simplicity. For the case of Lebanon, a core CPI excluding Energy and Food has been computed and applied to the CPI series calculated by the Central Administration of Statistics (CAS) since 2008. It excludes both Food and Energy categories (with a weight of 31.8%) from the CPI index.

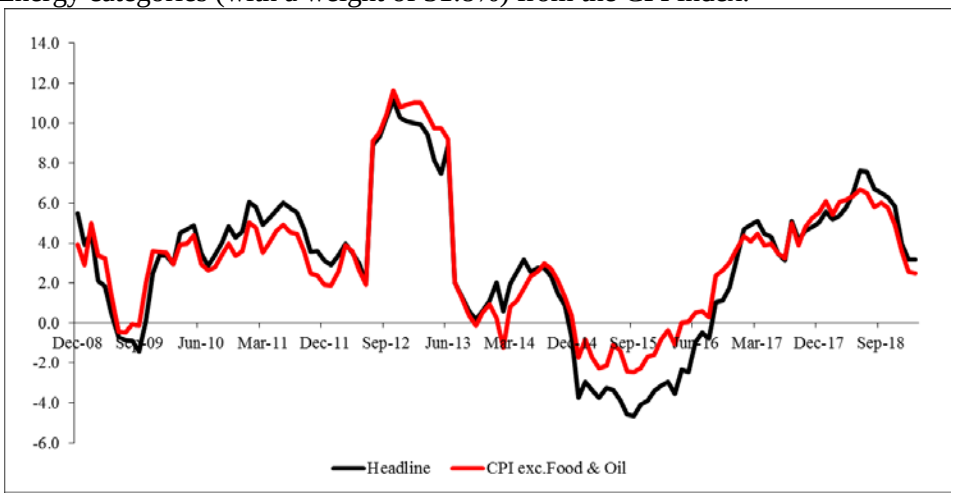

Figure 2: Headline versus Core CPI (year on year change)
Sources: CAS, BDL

Based on figure 2, we can notice that headline CPI is more influenced by oil prices and, consequently, more volatile than core CPI. For instance, the jump in prices which happened in 2009 is essentially due to the Brent price increase. As expected, the core CPI is slightly less impacted by the shock on oil prices and stands below headline CPI during the period 2009-2011. The opposite happened in 2014, when Brent prices dropped drastically: the drop of core CPI is smaller than the one of headline CPI.

Nevertheless, we also notice that core CPI is only a partial improvement to headline CPI since the effects of oil prices are still clearly seen in the graph. Actually, this approach relies on the fact that components are classified into two clear separate groups: those impacted by domestic monetary measures and those exclusively influenced by external factors. Unfortunately, this assumption does not hold for many reasons:

- Some items are impacted by external and internal factors. For instance, transportation prices are clearly impacted by the world price of oil as well as by the level of wages in Lebanon (bus driver, mechanic).
- Cost of imports can be transmitted to all items through indirect or second-round effects. For instance, an increase in the price of imported capital machinery and raw materials affect indirectly all industry-related items of CPI.

b- Model-based approach:

In order to overcome the previous limitations, a regression model is proposed to estimate the importance of imported inflation in the total headline inflation in Lebanon. This model does not make any distinction between sectors but explains the variations in CPI using variables which describe both domestic and external economic environment.

The main external variables impacting consumer prices are:

- Brent price (US Energy Information Administration)
- Agricultural Index (World Bank)
- USD/EUR exchange rate (FED)

The domestic variables are the following:

- M3: money supply (BDL)
- WAIR: weighted average interest rate (BDL)

A dummy has been included for the year 2012 to account for the "jump" in CPI due to the change in its housing component. In addition to this "artificial" change, the year 2012 witnessed an increase of salaries in the public sector as well as a massive arrival of Syrian refugees which translated into higher demand and prices in the housing sector. As we can notice from figure 3, the variations in CPI closely follow the variations of the Brent price and Food Index.

[4] A detailed presentation of these methods can be found in an *IMF Staff paper* written by Mick Silver (check references).

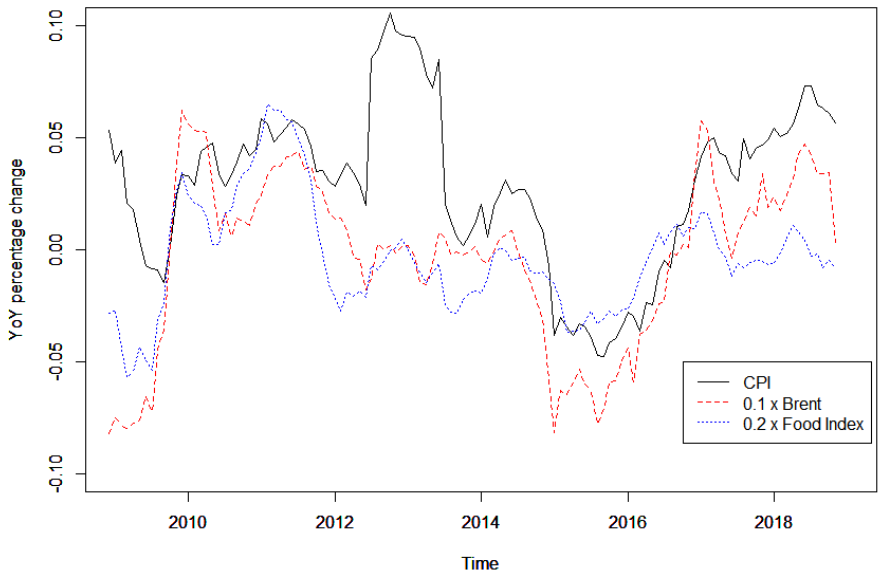

Figure 3: CPI, Brent and Food index
Sources: CAS, US EIA, WB Commodity Price Data

OLS estimation

Based on unit root tests, we decide to consider the first log-differenced series for the OLS estimation. Furthermore, due to the highly noisy nature of the month-on-month log-differenced series, we perform our estimation using year-on-year log-differences. Finally, the agricultural index and the Brent price are strongly correlated (0.75) which lead us to keep the Brent time series for the final estimation.

The following OLS regression has been performed:

$$\Delta(\log(\mathrm{CPI}_{\mathrm{headline}})) = \beta_0 + \beta_1\,\Delta(\log(\mathrm{M3})) + \beta_2\Delta(\log(\mathrm{WAIR})) + \beta_3\Delta(\log(\mathrm{BRENT})) + \beta_4\Delta(\log(\mathrm{EXR})) + \mathrm{dummy} + \epsilon$$

In addition to the headline CPI, we performed the same regression on a measure of the "core CPI" which excludes Food and Energy items. Such regression allows us to check that, when considering the core CPI measure, the impact of external variables is reduced.

Estimating each variable's importance

When explanatory variables are uncorrelated, the contribution of each variable in explaining the variations of CPI (improving R2) is unambiguous. However, when these variables become correlated, it is no longer clear how each one is impacting CPI. We decided to adopt the LMG (Lindeman, Merenda, and Gold) measure for assessing the relative importance of each variable in the linear regression model. The way this measure works is pretty simple: adding a variable (WAIR, for example) to the regression improves the goodness-of-fit R2 metric by a given amount (R2 jumps from 0.49 to 0.55, improvement = 0.06). When the explanatory variables are correlated, the amount of such an improvement (0.06) depends on which variables are already included in the model before we added the new variable (WAIR). The LMG measure averages these improvements over all possible orderings of regressors. In general, the LMG measures do not add up to 1 since variations in CPI are not perfectly explained by our variables.

II- Results

The results of the sectorial approach are presented in figure 4 and it can be pointed out that:

- The portion of Lebanese inflation that comes from non-tradable items such as health, housing and education represents only 26.6%. These items are purely domestic and are not directly impacted by global trade. The majority of other items are tradable especially food and energy items.
- Food and non-alcoholic beverages constitute a major component of Lebanon's consumer price index, with the highest weight of 20%. The food price index in Lebanon has been increasing faster than the consumer price index indicating rising food prices. In fact, food prices have increased by an average annual rate of 5% during the period 2010-2013 against 2% during the period 2012-2018. This comes in line with trends in international food prices which also increased by an average annual rate of 6% during the same period. Since Lebanon imports most of its food demand, it is consequently highly exposed to international food price fluctuations.

- The items that contribute the most to inflation are Energy (36.1%), Food and non-alcoholic beverages and Housing (15.9% each). Such a result confirms our main intuition that Food and Energy prices fluctuations have significant repercussions on headline inflation. Even though the share of the energy item in the CPI basket is only equal to 11.8%, it explains 36.1% of the volatility of headline CPI. If we add to that the transportation item which is directly impacted by the price of fuel, the direct effects of oscillations in oil prices explains 49.8% of the volatility of headline CPI. This result confirms that imported inflation, in particular the one due to variations in world oil prices, is the main driver of headline CPI inflation in Lebanon.

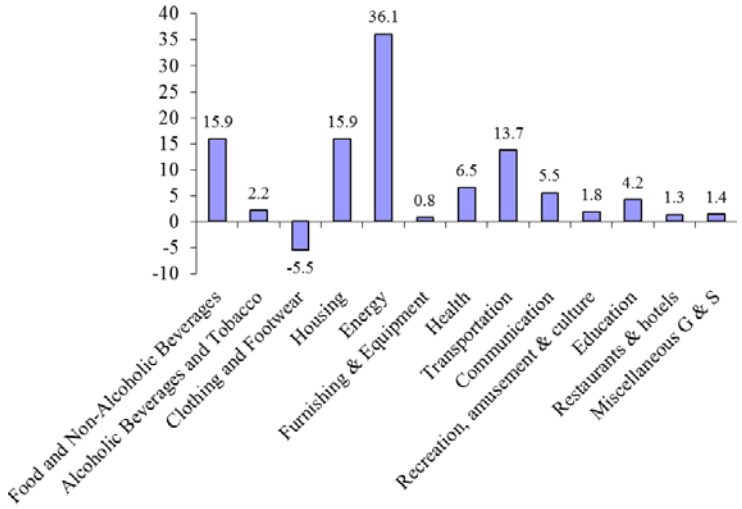

Figure 4: average components contributions to inflation between 2012 and 2018

As opposed to the sectorial analysis, the econometric model quantifies the impact of external factors regardless of the sectors through which these shocks are transmitted. Consequently, the second approach complements and provides a robustness check to our initial results. The estimation of the linear model using the log-differenced headline CPI as the explained variable yields the following result:

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	0.016912	0.005937	2.849	0.00521	**
diff(log(m3), lag = 12)	0.081031	0.065438	1.238	0.21815	
diff(log(wair), lag = 12)	0.033654	0.036932	0.911	0.36408	
diff(log(brent), lag = 12)	0.064796	0.007147	9.066	4.15e-15	***
diff(log(exr), lag = 12)	-0.036789	0.030017	-1.226	0.22287	
dummy	0.063302	0.006737	9.397	7.07e-16	***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.02185 on 114 degrees of freedom

Multiple R-squared: 0.6565, Adjusted R-squared: 0.6415

F-statistic: 43.58 on 5 and 114 DF, p-value: < 2.2e-16

The Brent price is clearly highly significant and confirms that the world oil prices are a major driver of Lebanese inflation. The model estimates that a 1% increase in the price of oil leads to an increase of 0.065% in inflation, a very strong result given the highly volatile nature of the Brent price level.

In addition to the headline CPI, we performed the same regression on a measure of the “core CPI” which excludes Food and Energy items. Such regression allows us to check that, when considering the core CPI measure, the impact of external variables is reduced.

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	0.016152	0.004957	3.258	0.00148	**
diff(log(m3), lag = 12)	0.104585	0.054642	1.914	0.05813	.
diff(log(wair), lag = 12)	0.074915	0.030839	2.429	0.01669	*
diff(log(brent), lag = 12)	0.045214	0.005968	7.576	1.02e-11	***
diff(log(exr), lag = 12)	-0.027909	0.025065	-1.113	0.26784	
dummy	0.069336	0.005625	12.326	< 2e-16	***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.01825 on 114 degrees of freedom
Multiple R-squared: 0.6828, Adjusted R-squared: 0.6689
F-statistic: 49.08 on 5 and 114 DF, p-value: < 2.2e-16

As expected, the elasticity of Brent decreases to 0.045 but this variable remains very significant proving that the exclusion of the Food and Energy items is not enough to eliminate the indirect effects of oil prices. Furthermore, we notice that the coefficients for interest rates and money supply become significant at the 5% and 10% levels respectively. In addition to that, their elasticities are higher than the ones found for headline inflation meaning that core inflation reflects more distinctly the impact of monetary policy than headline inflation.

Measure	Headline	Core 3 (excl. food & energy)
Δ(log(M3))	0.3 %	0.4 %
Δ (log(WAIR))	0.1 %	0.9 %
Dummy	26.6 %	41.8 %
Δ(log(Brent))	31.5 %	20.3 %
Δ(log(EXR))	7.2%	4.9 %

Table 1: LMG measure of relative importance

Finally, the estimation of the LMG measures can be found in table 2, and the following remarks could be made:

- The Brent price explains more than 30% of the variation in the headline CPI. When considering core CPI which excludes the energy item, this participation is significantly reduced. Nevertheless, it remains significant which means that Brent price has spillover/indirect effects on other items of CPI (transportation, for example).
- The housing "shock" (modeled by the dummy variable) has a tremendous impact on CPI. This impact increases as we remove the Energy and Food items from CPI.
- WAIR and M3 have a relatively minor impact on CPI. It should be noted that we are considering a model with differenced series. In a model with levels (such a VECM), M3 would be a main driver of CPI (both time series are cointegrated).

III- Conclusion

Both approaches lead to the same clear conclusion: Lebanese inflation is mainly driven by external factors, in particular the world price of oil. Such external shocks affect directly and indirectly most items in the CPI consumption basket. Despite a small decrease in its coefficient compared to headline CPI, the influence of the Brent price on core CPI remains significant. As expected, the impact of monetary policy on inflation is more significant when considering core inflation.

This study confirms that the small, open and oil-importing economy which is Lebanon is extremely sensitive to external factors such as world oil prices when it comes to inflation. Such external factors account for approximately half of the volatility of inflation. Despite its limitations, the core inflation measure is a better alternative than headline inflation when it comes to conducting monetary policy since it filters out the direct effects of external shocks and reflects more accurately the impact of money supply on inflation.

References:

Corrigan, T. D. (2005). The Relationship Between Inport Prices and Inflation in the United States. WCOB Faculty Publications, Paper 18. Retrieved from http://digitalcommons.sacredheart.edu/wcob_fac/18

Hamilton, J. D. (2012, March). Import Prices and Inflation. International Journal of Central Banking, 8(1), 271-279.

Jad, S. S. (2013). Measuring Core Inflation for Lebanon, www.bdl.gov.lb.

Johnson, M. (n.d.). Core Inflation: A measure of inflation for policy purposes. Montreal.

McCarthy, J. (1999). Pass-Through of Exchange Rates and Import Prices to Domestic Inflation in some Industrialized Economies. New York: Federal Reserve Bank of New York.

Mishkin, G. F. (2007, October 20). Headline versus Core Inflation in the Conduct of monetary Policy. Montreal, Canada: The Federal Reserve Board.

Motaza, M. G., & Farah, N. (2009). Estimating Inflation Rates of import-Concentrated Commodities.

Muktadir-Al-Mukit, D., Shafiullah, A. Z., & Ahmed, M. (2013, 1 1). Inflation Led Import or Import Led Inflation: Evidence from Bangladesh. Asian Business Review, 2(4), 2/2013.

Silver, M. (2007). Core inflation: Measurement and statistical issues in choosing among alternative measures. *IMF Staff papers* 54.1 : 163-190.

.