

Inflation Dynamics in Algeria: A closer look at the Consumer Price Index

Abstract

In this paper, we analyze Inflation Dynamics in Algeria between 2002 and 2016. For a better understanding of inflation we split the Consumer Price Index (CPI) into its components and we explore its basic time series properties. For the analysis, we used a Vector Auto Regressive model (VAR), impulse response functions (IRF) and variance error decomposition (VDC) to uncover possible links between the components of inflation. According to the results we found, inflation in Algeria is persistent; shocks are lasting longer and having impact on the future inflation path.

Key words: Inflation dynamics, Inflation persistence, The Algerian economy, Vector Auto Regression (VAR).

1 .Introduction

In the first decade of this century, inflation has known a stabilized situation. In 2005, the inflation rate dropped to 1.6% after hitting an unprecedented level Algeria never experienced since its independence estimated at 0.34% in 2000. Between 2005 and 2011 inflation rate in Algeria registered a slight increase to reach 4.5% in 2011 but in 2012 a very important hike was recorded of about 11% which was explained by the increase in food prices (+19.6 percent for fresh food) and manufactured goods prices. Higher prices were spurred by the excess liquidity resulting from the surge in current public spending and large hydrocarbon income (IMF 2012). In 2013 inflation rate reached 4.5% which was the rate targeted by the bank of Algeria. While it retreated in 2014 to average 2.9 percent, average year-on-year inflation exceeded the 4 percent target of the Bank of Algeria in 2015. It was partly driven by higher import price inflation, suggesting some degree of exchange rate pass-through as the dinar depreciated significantly against major currencies in 2015.

In fact starting from mid-2014, inflation started accelerating again gradually to reach 6.9 percent average year-on-year by December 2016 as a consequence of a sustained rise in manufactured goods prices, which represented 55% on average to overall inflation. In 2016, a significant fluctuations in food prices was the origin of the the peak of inflation registered in July of about 8.1 percent before decreasing for a while, then increased once again toward the end of the year.

An IMF study on the causes of inflation in Algeria, IMF (2013)¹ pointed out that a decrease of loans to the public sector by more than 20% in 2012, contributed to increase the inflationary pressures, while loans growth to the private sector decreased by 10% in 2012. The monetary authorities raised the mandatory reserve on deposits in the banking system from 9 to 11% by expanding the absorption of liquidity estimated at 250 billion AD (23%). This study was preceded by another study, Koranchelian, (2004) found that both real and monetary factors have an impact on inflation. Inflation is associated in the long term positively with money supply and the exchange rate and negatively with income. Thus, the rising incomes of the families do not have a positive impact on the high rate of Inflation. The author suggested that the monetary authorities must continue a prudent monetary policy to cope the inflationary pressures. Ben Naceur (2012) by studying the short and the long-run determinants of inflation in Algeria for the period from 2002 to 2011 found that only non-oil GDP gap explains inflation in the short run and in the long run he found money supply and real GDP to be the most important determinants of inflation.

An important aspect of fiscal policy in Algeria is its procyclical character (Menna & Mehibel. 2017, Chibi et al. 2014) and its impact on inflation (Menna & Mehibel. 2017). The aspect of cyclicalities have the potential of putting pressures of instability in the economy², such as rising inflation. Among the first reasons cited by the Bank of Algeria in an analytical note on inflation in Algeria (Bank of Algeria, 2013)³ and that could be among the causes of this increase in the rate of inflation that needs to be investigated, is the increase in wages of public sector jobs and the economic public sector, which had an effect on expectations of other economic agents that the potential consumers have a surplus liquidity will therefore inevitably consume it, so it will be applied on the prices of fresh goods. Since the high level of these prices plays an important role in the formation of inflationary expectations.

In this sense, government spending can have a significant cyclical influence on economies' fundamental variables, including consumption and investment. Government spending (as a ratio of GDP), after the oil windfall of the early 2000s registered an important increase starting from 1963 with 22 percent of GDP to reach 27.1 percent of GDP in 2005 before peaking at 44.6 percent of GDP in 2012.

² "Siklikalitas Kebijakan Fiskal di Indonesia", Research Note No.11/15/DKM/BRE/CR, Bank Indonesia.

³ Banque d'Algérie. 2013 . Inflation accelerates in 2012 in the context of currency deceleration: the need to stem the inflationary phenomenon in 2013

Despite some consolidation in 2013, public spending in Algeria remains one of the highest in the region, and far above the average in the other MENA oil exporters (IMF 2014). Government spending after the oil windfall was characterized by a very expansionary fiscal policy starting from (2001-2004) investment program called the Economic Recovery Program which was followed by a series of public investment programs (2005-2009 “Complementary Plan for Growth Support” and 2010-2014). In order to face the crisis and maintain social peace, the government changed the structure of spending in favor of wages, salaries, subsidies, and transfers but as consequence fueled inflation and introduced expenditure rigidities.

The aim of this paper is analyse inflation persistence by studying the structure of the consumer price index (CPI). To do so, the paper is organized as follows: Following this introduction we go through a relevant literature on inflation in section 2; Section 3 passes in view of the composition and the structure of the consumer price index (CPI) in Algeria; Section 4, is devoted to the econometric study of inflation persistence and through a VAR approach we try to understand which inflation component is leading the others; We end our paper by a conclusion.

2 .Literature Review

The main inflation determinants can be put into three groups: (i) Demand pull inflation; (ii) Cost push inflation and (iii) Inflation driven by inflation expectations. Their relative importance is varying from country to another and changing over time according to five main economic factors⁴ starting from the utilization of economic resources which determines the level of output gap and hence the demand pull inflation and on the cost push inflation side, it can be caused by the supply side shocks of major commodities like food and energy. Besides, the changes in exchange rate can affect the general price level through the “pass through effect”. Finally, the other important factor is the credibility of the monetary policy and its ability to target inflation expectations about which an appropriate proxy must be choosen.

The focus of most of the recent economic studies in the last century was on the relationship between inflation and unemployment (Phelps, 1967); the recent economic literature are mainly concerned about the analysis of Inflation Dynamics (Barnett et al. 2012). We define inflation dynamics as "a non transitory change in

⁴ Davis, Joseph H. “Evolving Inflation Dynamics: Expectations and Investment Implications”, Vanguard Investment consulting & Research, 2007.

the value, trend and the continuity of inflation over time due to changes in the relative importance of the factors motivating the inflationary process"⁵.

Basher and Elsamadisy (2012) investigates the main sources the sources and transmission of inflation in GCC countries over the period 1980-2008 and suggested that inflation in trading partners, money and the nominal effective exchange rate are affecting inflation in the short run and only money is affecting inflation in the long run. Kandil and Morsy (2009) examined the determinants of inflation in GCC countries for the period between 1970 and 2007 and found that inflation in trading partners is very important in affecting inflation, while in the long run public capital spending helps easing inflationary pressures and excess demand is an important determinant in the short run.

It is well known that the transmission of fiscal policy to inflation can be through the aggregate demand, spillovers of public wages to private sector, as well as the effect of taxes on private sector marginal costs and consumption. By using quarterly data for a sample of 17 industrial economies, Kandil (2006) studied the asymmetry in effects of monetary shocks and government spending shocks and found a negative correlation between government spending and price inflation in most countries of the sample. Similar results were found in the works of Cukierman (1992) and Becker and Mulligan (2003).

An empirical application of the Ruge-Murcia's 1999 work on Brazilian monthly data for a period spanning from 1980 to 1989 showed that inflation and money growth rates are associated with government spending regimes. Ezirim et al. (2008) by investigating the relationship between the growth rate of public spending and the inflation rate for the United States of America, for the period 1970-2002, found a positive correlation between the two variables and also a bi-causal relationship between them. It was widely recognized that public expenditure growth can aggravate inflationary pressures in many studied cases. However, some works as in Magazzino (2011) for the case of Mediterranean countries did not find clear results of whether government spending influences prices dynamics.

The contribution of this paper is to examine the persistence of the sub components of inflation in Algeria by focusing on the analysis of the structure of the consumer price index (CPI) and to determine which sub component of the consumer price index (CPI) leads the others.

⁵ It is worth mentioning that there is no common or agreed upon definition for this phenomenon, Therefore, the study attempted to draw a precise definition of the phenomenon through reviewing various studies available in this regard.

3 .Composition and Structure of the Consumer Price Index (CPI)

The Algerian consumer price index (CPI) is released monthly by the National Office of Statistics and is composed of a sample of 260 goods and services. Every basket is weighted basing on the 1988 National Household Consumption Survey, and the reference year is 2001. The CPI is calculated according to the Laspeyres formula.

Table1. Descriptive Statistics of the Overall Inflation Rate and the Main Subcomponents

Sample: Feb2002- Dec2016	Weights	Mean (in Percent)		Standard Deviation		Coefficient of Variation	
		Year-on- Year	(Seasonnaly Adjusted) Month-on- Month	Year-on- Year	(Seasonnaly Adjusted) Month-on- Month	Year-on- Year	(Seasonnaly Adjusted) Month-on- Month
Overall CPI	1000	4,4	0,3	2,3	0,8	0,5	2,4
Food Prices	430,9	5	0,4	4,1	1,8	0,8	4,5
Clothing and Footwear	74,5	3,7	0,3	4,2	0,5	1,1	1,6
Housing and Utilities	92,9	3,1	0,2	2,3	0,6	0,7	2,5
Furnishing and Household Equipment	49,6	2,5	0,2	1,7	0,5	0,7	2,2
Health	62	3,2	0,3	1,9	0,5	0,6	1,8
Transportation & Communication	158,5	4,7	0,4	4,5	1	1	2,7
Recreation and culture Education	45,2	2,1	0,2	3,7	1,8	1,8	9,9
Others	86,4	5,6	0,4	5,5	1,1	1	2,4
Underlying CPI	410,6	3,6	0,3	2	0,3	0,6	1,1

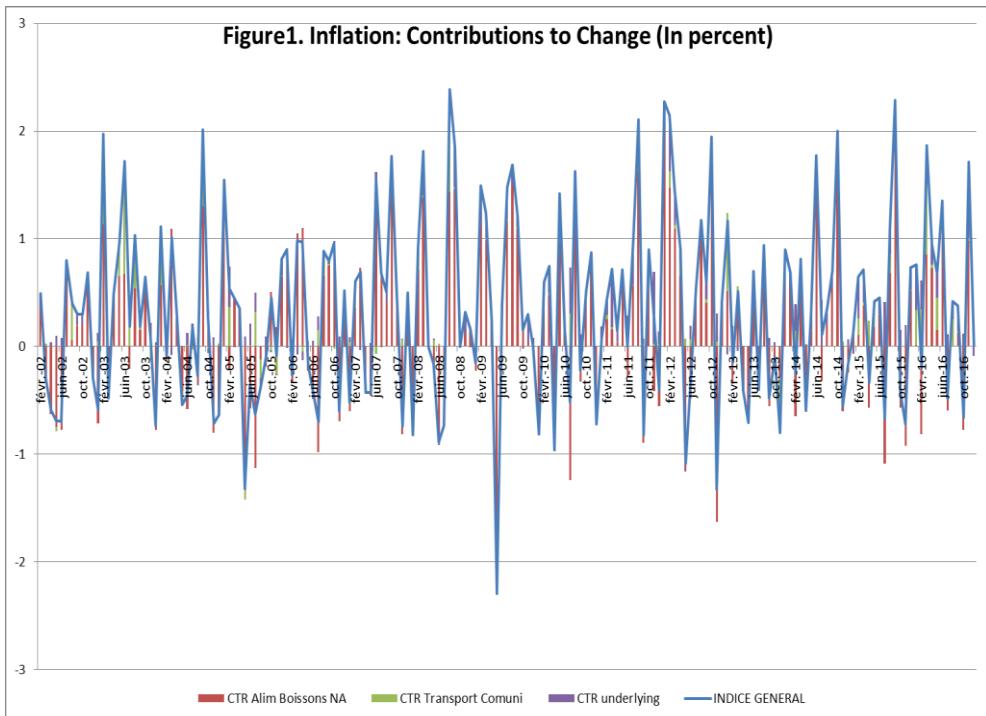
Source: National Office of Statistics & our estimates

In order to better understand the inflation dynamics in Algeria we split the consumer price index into its components. We distinguish hence eight sub-indices (as mentioned in the table above).

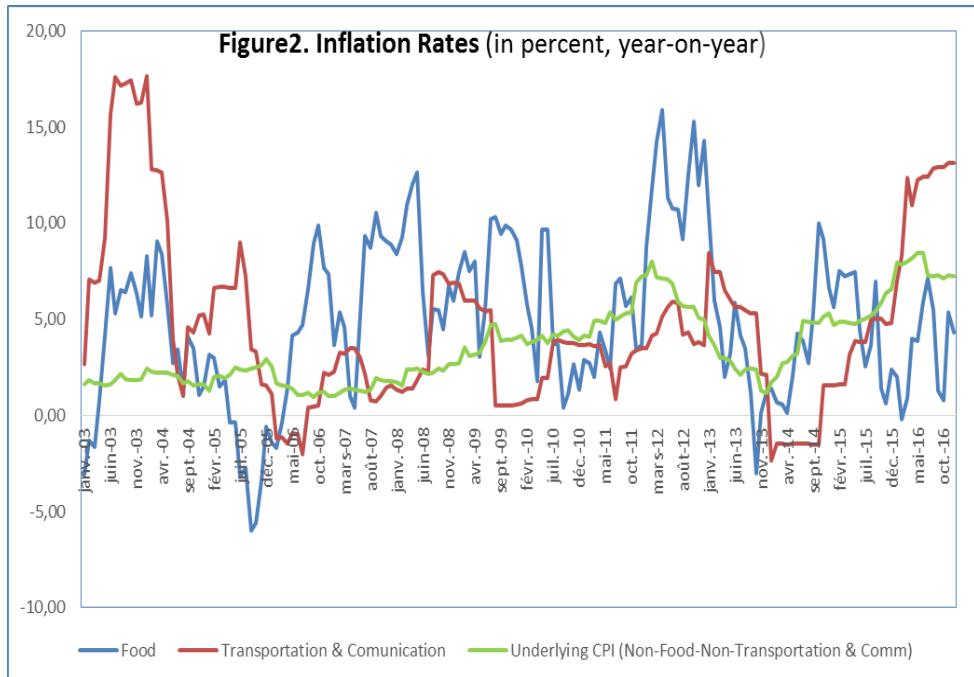
According to Table 1, Food and Beverages account for 43 percent of the consumption basket and are considered as a key driver of changes in inflation and of inflation volatility. Food prices constitute the largest bucket in the CPI and are more volatile than other components and its volatility is confirmed in Figure 1 and

2 comparing to underlying prices that appears to be less volatile than food prices and transportation and also the contribution of food inflation to the overall inflation is clearly apparent and we have in the second position transportation which account for 16 percent of all the basket.

Underlying inflation which does not include food and transportation, shed light on the aggregate demand-driven inflationary pressures than overall inflation. The measure of underlying inflation accounts for less than half of the CPI basket which makes it a fairly weak measure



Source: National Office of Statistics & our estimates.



4 .Econometric Analysis

We explore here the time series properties of inflation and its subcomponents to determine how long does it take inflation to return to its equilibrium after being hit by a shock; that is, how quickly do inflation shocks dissipate? Do shocks have a permanent impact on inflation? Which sub-components of inflation leads the others?

We use in first a simple autoregressive model to capture inflation persistence (Jeffrey.C.F, 2014). At a second step we use Vector Auto-Regression (VAR) analysis to illustrate how shocks propagate and to understand which structural shocks help explaining variance in forecast errors.

4.1 .Inflation Persistence

Inflation shocks in Algeria are almost long-lived as they take merely a year and a half to dissipate. A simple autoregressive model for the overall inflation yields a coefficient of about 0.58 on its first lag, which means that one third of the inflationary impact of a shock has already dissipated after one period (Table 2). In other words, if a shock increases inflation by 10 percentage points on impact, in the following quarter would be 5.8 percentage points higher, and by the fourth quarter, 89 percent of the inflationary impact of the shock would have dissipated. If we

base only on expectations to determine the current inflation rate, so inflation would be expected to return to its average rate within a year and a half.

Underlying inflation is less persistent than overall inflation, but even shocks to underlying inflation do not last too long. After one year only less than 8 percent of the inflationary impact of a shock would persist (Figure 3).

Food inflation, however, shows the least persistence comparing to overall inflation and underlying inflation. After one year about 2 percent of the inflationary impact of a shock would persist (Figure 3). These results about food inflation are quite logical given its high volatility. Almost 64 percent of a shock dissipates each period.

Table 2. Algeria: Persistence in CPI and its Subcomponents
(Seasonally adjusted, average quarter-on-quarter inflation rates)

	Constant	1 st Lag	Adjusted R-Squared	Durbin-Watson	Akaike Info	Schwarz Info
Overall Prices	0.436588** * (0.131684)	0.584499** * (0.109527)	0.33711 2	1.77337 2	1.60373 2	1.67478 2
Food Prices	0.766301** * (0.222078)	0.341177** * (0.125607)	0.10063 2	1.84976 4	3.35856 9	3.42961 9
Underlying CPI	0.451948** * (0.132764)	0.534988** * (0.113819)	0.28290 8	2.04634 2	1.84297 1	1.91402 1

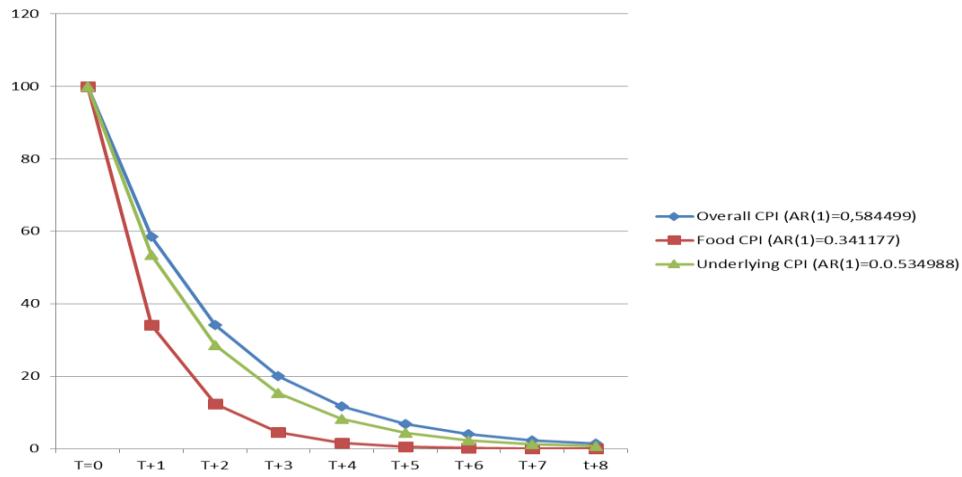
Source: Our estimates

Note: Coefficient on own lag, Standard deviation in parentheses.

*Indicates 10 percent, **indicates 5 percent, and ***indicates 1 percent significance, respectively.

In order to measure persistence we can use also the method of “Sum of Autoregressive Coefficients” or SARC first proposed with some modifications in Andrews and Chen (1994) as a better measure of single-number estimate of long-run dynamics than unit root test.

Figure 3. Inflation: Persistence of Shocks
(In percent, Seasonally adjusted, quarter-on-quarter)



Source: Our estimates.

4.2 .Vector Auto-Regression Analysis

In view of the results presented so far we can assume that inflation represents different properties. These findings make us conclude that different elements are pushing and pulling inflation which must be taken into consideration. That does not mean that there are no common factors, but the evidence confirms the existence of some distinct shocks to food prices as well as to underlying inflation. In the following we use a multivariate approach to model this clearly.

We estimate a VAR on the quarter-on-quarter seasonally adjusted underlying (UDR) and food (ABN) inflation rates. The unit root test (Augmented Dickey-Fuller) we run gave us a confirmation that both inflation series are stationary. The selection criterion suggests using one lag in modeling (Table 3).

Table 3. VAR estimation results

	ABNSM	UDRSM
ABNSM(-1)	0.322869 (0.12524) [2.57809]	0.021667 (0.05966) [0.36318]
UDRSM(-1)	0.338557 (0.24212) [1.39829]	0.530608 (0.11534) [4.60024]
C	0.469079 (0.30606) [1.53263]	0.430913 (0.14580) [2.95545]

The results indicate that for the two variables each lagged variable of them is significant which means that underlying inflation is explained only by its lagged variable and food inflation is explained only by its lagged variable.

For identification purposes, we say that underlying inflation is largely hit by aggregate demand shocks, while food prices, in contrast, are subject to both aggregate demand and supply shocks. These supply shocks will also affect underlying inflation through higher food prices but with a lag. This assumption is implemented through a Cholesky decomposition. Granger-causality tests suggest that there is some, albeit weak, evidence of food price inflation leading underlying inflation, supporting our identifying assumption.

The impulse response function presented below (Figure 4) shows that a shock of food inflation lasts between 6 to 7 periods before fading and has an impact estimated at about 0.018846 in the second period on underlying inflation and an impact of 1.264849 on itself starting from the first period.

Regarding the impulse response function of underlying inflation's shock, we can observe that it lasts between 7 to 8 periods to dissipate with an impact of -0.016132 on food inflation which represents the highest levels of impact and 0.602338 on itself from the beginning.

Variance decomposition (Table 4) indicates that about 74 percent of the forecast errors of food inflation can be explained by its own innovations and the 25 percent left of the forecast errors are explained by the innovations of underlying inflation. When we put it differently, we can say that the aggregate demand explains 25 percent of food prices and supply shocks explain 75 percent of food prices. For underlying inflation 96% of its forecast errors are explained by its own innovations which means through the aggregate demand and the 4% left by the innovations of food inflation or supply shocks.

On the other hand, 96 percent of the forecast errors of underlying inflation are explained by its own innovations and the 4 percent left are explained by food inflation's innovations. Economically speaking, 4 percent of the forecast errors are explained by the supply shocks and 96 percent are explained through the aggregate demand.

Figure 4. The Impulse Response Functions

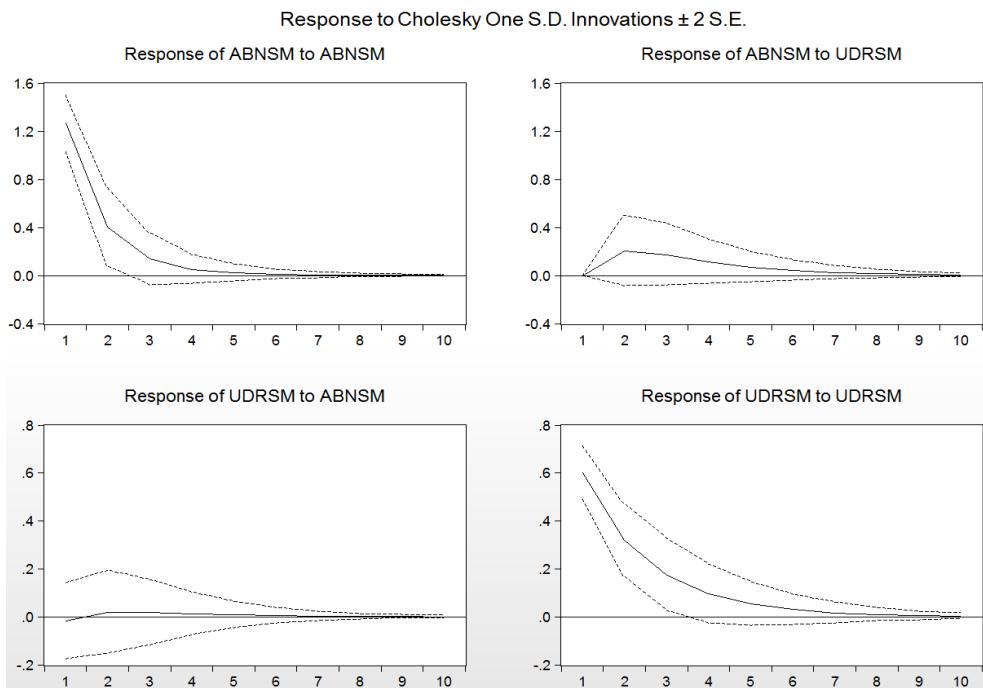


Table 4. Variance decomposition

Response of ABNSM: Period	ABNSM	UDRSM
1	1.264849 (0.11744)	0.000000 (0.00000)
2	0.402919 (0.0619)	0.203926 (0.0616)
3	0.136470 (0.10707)	0.174046 (0.12705)
4	0.050403 (0.06036)	0.115104 (0.09138)
5	0.009490 (0.03490)	0.099690 (0.06165)
6	0.009350 (0.02076)	0.040611 (0.04165)
7	0.004596 (0.01242)	0.023231 (0.02732)
8	0.001339 (0.001740)	0.013168 (0.01767)
9	0.001285 (0.00438)	0.007429 (0.01129)
10	0.000705 (0.00258)	0.004181 (0.00714)

Response of UDRSM: Period	ABNSM	UDRSM
1	-0.016132 (0.0751)	0.602338 (0.0553)
2	0.018946 (0.08655)	0.319605 (0.07555)
3	0.018730 (0.06795)	0.174004 (0.07520)
4	0.002895 (0.0412)	0.096009 (0.04101)
5	0.007934 (0.02721)	0.053485 (0.04505)
6	0.004657 (0.01624)	0.029890 (0.03147)
7	0.002548 (0.00558)	0.017700 (0.02117)
8	0.001518 (0.00563)	0.009386 (0.01387)
9	0.000857 (0.00330)	0.005265 (0.00891)
10	0.000483 (0.00193)	0.002955 (0.00563)

Cholesky Ordering: ABNSM UDRSM
Standard Errors: Analytic

According to the results of impulse response function and variance decomposition we can assume with weak evidence that underlying inflation leads food inflation. This means that underlying inflation is hit by aggregate demand and it shows that supply shocks seem powerless to affect underlying inflation in return. In other words, any supply shock has no impact or the least we can say a really very low impact on food inflation even through high food prices. Aggregate demand shock affects both underlying and food inflation, with a slightly larger impact on underlying inflation (Figure 4). A one standard-deviation aggregate demand shock increases underlying inflation by about 60 percentage points in the first period and food inflation by 20 percentage points in the second period. Looking now at the supply shock side, a one-standard deviation supply shock, which by construction affects only food inflation pushes it up by 13 percentage points in the first period and increases underlying inflation by 2 percentage points in the first period which is considered as weak. All the shocks here for the two sides demand and supply dissipate after 7 or 8 periods and has no statistically significant effect afterwards.

5 - Conclusion:

We focused in this paper just on the inflation indices by exploring its time series properties. In the first part we studied inflation persistence for food inflation and underlying inflation by estimating a simple auto-regressive model and we found that shocks of food inflation are less persistent than shocks of underlying inflation. We can say that Inflation shocks in Algeria are almost long-lived as they take merely a year and a half to dissipate.

Through VAR analysis we illustrated how shocks propagate and we identified which structural shocks help explain variance in forecast errors. The assumption we made here is that underlying inflation is largely hit by aggregate demand shocks, while food prices, in contrast, are subject to both aggregate demand and supply shocks. The estimations through the VAR approach suggest the existence of evidence pointing that underlying inflation leads food inflation. The impulse response function results indicate that a shock of food inflation lasts around 1 year and a half before fading and nearly 2 years for underlying inflation's shock to dissipate.

The analysis of Variance decomposition suggested that Volatility in food inflation can be explained in its large part by the supply shocks (75%) and the remaining 25% through the aggregate demand. On the other hand, volatility in underlying inflation can be explained in 96% through the aggregate demand.

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