Short-Term Forecasting Algerian Inflation using ARIMA Processes

Kamel Si MOHAMMED, Abderrezzak BENHABIB, Sidahmed ZENAGUI

Abstract—Inflation appears as a first challenge for the recent Algerian economic performance. The goal of this study is to forecast the performance of the Algerian inflation rates by applying the Box - Jenkins approach (1976) to the following series from M2 2006 to M12 2014 as full period estimation, then the full period M2 2014 to M2 2015 as an ex post forecast period and M3 2015 to M2 2016 as forecasting short-term period. ARIMA Results appear to exhibit better forecasting inflation trend with a slight real downward tendency.

Index Terms—inflation, forecasting, ARIMA Model

I. INTRODUCTION

The first half of the 1970’s witnessed a stable inflation rate that oscillated between 3 to 6% that, unhappily, began to show an increasing tendency from 1975 to 1988 with an average annual inflation rate of 9.96%. This peak can be explained by many reasons including the implementation of a new Algerian exchange rate regime that is based upon a basket of 14 currencies’ instead of the strict beg. The second reason behind the high inflation rate during the 1975-1988, is contained within the core inflation itself, as measured by the dominance of food products that contributed up to 50 % to the total increase in imports due to trade openness looseness. Price stability, considered actually as great challenge for the bank of Algeria, has been largely impacted by CPI increase from the 90’s. Average CPI inflation was 18.55% in the first decade of the estimated study (1990s). On the contrary in the second decade 2000’s, inflation had witnessed its lowest rate approximating a rate of 3.2 %. After the end of the first decade of the new millennium and the beginning of the second decade, inflation increased substantially to levels that vary between 6 to 8.5 % . During the last Five years (2010-2015), price stability benefited from a better rate compared with the two last decades that exhibited a decrease in inflation rate averaging 5%. This study uses the Markov Switching model to examine the relationship between Algerian Inflation and inflation Uncertainty using quarterly data for the period 1974-2014.

The rest of the paper is organized as follows. In section 2 we present a Review Literature the relationship between Algerian Inflation and inflation Uncertainty. Section 3 presents the Model and the Methodology. Section 4 shows the results followed by discussion. Finally, the main conclusion are drawn in the fifth section.

II. LITERATURE REVIEW


On the contrary, Meyler et al (1998)²⁴ found an appropriate ARIMA technique compared with the objective of a penalty function method for forecasting Irish inflation. Pufnik and Kunovac (2006)²⁵ developed Seasonal ARIMA Processes for a Short-Term Forecasting of Inflation in Croatia that exhibited good performances. Suleman and Sarpong (2012)²⁶ predicted an 11 months forecast for the year 2012 in Ghana using ARIMA model. The Diagnostic test of the model residuals indicates some good forecasting results with slight volatility in the inflation pattern.

Baci (2015)²⁷ used autoregressive processes, moving average processes (ARIMA) for forecasting the inflation rate in Romania during the period from January 1997 to August 2013. He succeeded in his estimation of the inflation rate for September 2013 that turned around 3.01 %.

III. MODEL AND METHODOLOGY

Definition of Autoregressive Integrated Moving Average - ARIMA

Autoregressive-Integrated-Moving Average Models (ARIMA) are the most famous models applied for the prediction of future trends by using time series data. This tool
was developed in 1976 by statisticians George Box and Gwilym Jenkins on the basis of non-stationary time series. The Box-Jenkins approach combines past autoregressive values (AR) and past error terms (moving average: MA) in order to identify the Rank (p, d, q) of ARIMA model as follows:

\[
\Delta p = \phi_1 \Delta p_{-1} + \phi_2 \Delta p_{-2} + \ldots + \phi_p \Delta p + \epsilon_t + \theta_1 \epsilon_{t-1} + \theta_2 \epsilon_{t-2} + \ldots + \theta_q \epsilon_{t-q}
\]

A R MA

Where \( p \) and \( q \) give the number of autoregressive and moving average terms, respectively, and \( \Delta \) denotes the first difference. The error term \( \epsilon_t \) is assumed to follow a white noise process with variance \( \sigma^2 \). See Huwiler and Kaufmann (2013). After identifying the number rank of ARIMA model and checking for the existence of white noise in the residuals that are estimated from ARIMA, the next step involves series forecasting based on the ARIMA model.

Results and Comment

Much econometric estimation, which use the least square method (GLS) produce spurious regression and their statistics indicate false and bias elasticity (Granger and Newbold, 1974). In this paper, Augmented Dickey-Fuller (ADF) and Phillips and Perron (1988) tests drawn from the stationary tests represented in figure below, allow a rejection of the null hypothesis in the first difference that signifies no stationary in all our series, but enables an acceptance at a level that signifies integration of the variables at order 1.

Table 1: ADF and PP Unit Root Tests

<table>
<thead>
<tr>
<th>Variables</th>
<th>Augmented Dickey Fuller (ADF)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
</tr>
<tr>
<td></td>
<td>intercept</td>
</tr>
<tr>
<td>Inf</td>
<td>-2.67</td>
</tr>
<tr>
<td>Philips Perron PP</td>
<td></td>
</tr>
<tr>
<td>inf</td>
<td>-2.64</td>
</tr>
</tbody>
</table>

*show values are significant at 5% level with MacKinnon (1996).

**show values are significant at 1% level with MacKinnon (1996).

***show values are significant at 5% and 1 level with MacKinnon (1996).

The two tables below preset the autocorrelation and partial correlation functions for identifying the rank of p and q at first difference level respectively by plotting correlogram test and Q-statistics stages for Box–Jenkins autoregressive moving average time series models. This first results of the analysis confirmed a non-stationary inflation variable at level and checking the autocorrelation and partial autocorrelation function at first difference shows the fits of the inflation time series near to zero and a drop inside the confidence bands (statistically significant at 5% at first difference).

Table 2: the autocorrelation and partial autocorrelation functions

<table>
<thead>
<tr>
<th>Partial Correlation</th>
<th>AC</th>
<th>PAC</th>
<th>Q-Stat</th>
<th>Prob</th>
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<tbody>
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<td>0.885</td>
<td>84.625</td>
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<tr>
<td>.{}</td>
<td>0.758</td>
<td>-0.119</td>
<td>147.24</td>
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</table>

Table 03: Q-statistic probabilities

<table>
<thead>
<tr>
<th>Autocorrelation</th>
<th>Partial Correlation</th>
<th>AC</th>
<th>PAC</th>
<th>Q-Stat</th>
<th>Prob</th>
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<td>245.03</td>
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Test of heteroskedasticity

Breusch-Godfrey Serial Correlation LM test accepted the alternative hypothesis that Chi-Square is more than 0.05. The same results we detected for Q-statistics which are greater to the level meaning there are no autocorrelation errors and allows the model to become pertinent to forecasting purposes.

Table 04: Breusch-Godfrey Serial Correlation LM Test:

<table>
<thead>
<tr>
<th></th>
<th>F-statistic</th>
<th>Prob. F(2,87)</th>
<th>Obs*R-square</th>
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<td>4</td>
<td>2.902302</td>
<td>0.0602</td>
<td>0.0643</td>
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The final step consists of forecasting the future values of the inflation rate by using past values of the inflation rates. Usually we go through a series from M2 2006 to M12 2014 as a period estimation and resample the full period M2 2014 to M2 2015 as an ex post forecast period and M3 2015 to M2 2016 as forecasting in short-term future over one year. Then, we compare forecasts of the ARIMA model in real time (2015) and future time (2016) for the total inflation period by using Root Mean Squared Error and Theil Inequality Coefficient. Diagnostics of ARIMA forecasting results seems to give good evaluation, considering that the F-Statistic of the Regression of the Root Mean Squared Error and the Mean Absolute Error are significant. This important result can be confirmed by Theil Inequality Coefficient which is significant at 5%.

The main result is that the Algerian inflation can be predicted on the basis that it contains information about future inflation trend, see figure 1 and 2.

Figure 01: inflation forecasting

Figure 02: forecasting evaluation
Short-Term Forecasting Algerian Inflation using ARIMA Processes

CONCLUSION
Inflation has witnessed its lowest average at 3.2%. After the end, the first decade of the new millennium and beginning of the second decade, inflation was characterized by an increase in its rate to levels that range between 6 to 8.5%. The main findings allow us to assume that the inflation rate in Algeria will present some moderate stability in the future.

REFERENCES
[1] Australia, Belgium, Canada, China, France, Germany, Italy, Japan, the Netherlands, Spain, Switzerland, Sweden, Turkey, the United Kingdom, and the United States.