Journal of Economics and International Finance Vol. 3(5), pp. 328-336, May 2011
Available online at http://www.academicjournals.org/JEIF
ISSN 2006-9812 ©2011 Academic Journals

Full Length Research Paper

ARIMA (autoregressive integrated moving average) approach to predicting inflation in Ghana

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Accepted 28, march 2011

Inflation is defined as an increase in the general price level of goods and services within a period of time. For any economic agent to formulate a policy, it must take into consideration inflation and the aim of this study is to use autoregressive integrated moving average (ARIMA) model to predict inflation in Ghana. In order to fulfil this objective, monthly inflation figures were collected from Ghana Statistical Service covering the period 2000:6 to 2010:12 to build the ARIMA model. In building the ARIMA model, the Box- Jenkins approach has been used, thus inflation was found to integrated of order one and follows (6,1,6) order. Inflation was predicted highest for the months of March, April and May to be 8.95, 10.07 and 10.24% respectively. The root mean squared error (RMSE) was calculated at 0.115453, indicating the efficiency of predictability of the model built to predict inflation. It was therefore recommended that the appropriate measures must be put in place to prevent inflation spiral from setting in motion. This is so because our model suggests that, inflation has a long memory and that once the inflation spiral is set in motion, it will take at least 12 periods (months) to bring it to a stable state.

Key words: AR, MA, autoregressive integrated moving average (ARIMA), Inflation.

INTRODUCTION

Inflation is one of the problematic macroeconomic variables that occupy a central place in the management of most economies. This is so because it is mostly used as one of the indicators of the performance of a country's economy. Policy inconsistencies have often made it difficult for some policy makers to achieve the targeted rates of inflation in their countries, thus allowing the living standards at the devastating whims of inflation. Ghana is one of the countries whose economy has suffered the devastating effects of high inflation. Though the economy of Ghana chalked an enormous success at keeping inflation very low during the early days of post independence, the rate of inflation rocketed very high between 1972 and 1983, rising up to 123% in 1983 (McKay and Sowah, 2004). Throughout this period till the introduction of the economic recovery programme (ERP) and the structural adjustment programme (SAP) in April 1983, inflation still remained high. The success of ERP and SAP at reducing inflation was just a temporary respite. This is because; no sooner had the country returned to democratic rule in 1992 than inflation soared in double digits, about 28% by late 1994[1].

Policy makers in Ghana might not have been able to keep inflation at desired rates because of their inability to determine the predictors of inflation and its nature. In this way, any policy prescription administered as an antidote would be ineffective once a wrong diagnosis of the problem has been made. Thus, before any measures are taken to cure inflation, it is imperative that, policy makers take a proper diagnostic approach to determine the variables that establish a long-run stationary state relationship with inflation. These could include variables like, interest rate, money supply, Gross Domestic Product (GDP) and the exchange rate. In this way, appropriate predictions can be made taking into consideration the aforementioned variables; thus, the right policy measures can be implemented to control it.

Accordingly, inflation is a problem because it lowers incomes, discourages saving, makes productive inputs more expensive and may act as disincentive to hard

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[1] See Ghana- Debt and Inflation. Available at http://countrystudies.us/ghana/67.htm (Accessed : 19/01/05

work, thereby leading to sub-optimal per person real output growth or economic development (Kyereme, 2004). Though there is substantial amount of research on inflation in Ghana, less attention has been given to predicting inflation by comparing different models. Thus, models that predict inflation are worth considering as they can be used as a policy tool. For to predict inflation, is to formulate policies consistent with curbing it.

Statement of the problem

Inflation is a major macroeconomic variable that is not only used as a yard stick for measuring the performance of a country's economy, but it also provides difficult challenges to policy makers in Ghana. Inflation redistributes wealth in an ad-hoc way from real assets to financial assets. It also creates uncertainty about relative prices, investment decisions and growth. Ghana's experience of inflation is nothing good to write home about. The country's first taste of double digit inflation was in 1964. This was followed by a brief period of respite during 1967 to 71 when inflation was below 10%. From 1972 and the years forward, inflation kept soaring reaching 123% in 1983 (McKay and Sowa, 2004). Inflation was particularly high and volatile in the political turbulent 1970s and early 1980, but has persisted throughout the gradual ERP since 1983. Inflation has a lot of far reaching effects. It certainly increases the cost of investment and as such a great disincentive to investment with its attendant multiplier impact on the whole economy.

Again, according to the 1999/200 Ghana Living Standards Survey about 65% of the average Ghanaian expenditure is on food (Ghana Statistical Service, 2000). This implies that inflation can negatively affect the nutrition of Ghanaians and as such, the quality of the labour force. Inspite of the seemingly substantial research into inflation in Ghana over the years, policy makers and the ordinary person alike are still grappling with the problem of predicting inflation accurately. This can partly explain the inflation crisis management policies that have always been implemented, though these have more often than not failed.

Thus, the question still remains, can inflation in Ghana be predicted. If so what AR, MA, ARIMA order does inflation take.

Objectives

The main objective of this research is to adequately predict inflation in Ghana through ARIMA approach. In furtherance of this, the following specific objectives will be pursued:

1. To build an appropriate Autoregressive Integrated Moving Average (ARIMA) model for inflation in Ghana.
2. To make a forecast or prediction of inflation in Ghana.

LITERATURE REVIEW

Monetarists and structuralists perspectives

Both at the empirical and theoretical levels, economists have differed in their analysis of the causes of inflation. As a result, their prescribed solutions for inflation have also differed. Specifically, the debate about the causes of inflation is generally between the monetarists and the structuralists. The monetarists hold the view that sustained money growth in excess of the growth of output produces inflation[2] (Meltzer and Monetarism, 2002). They argue that, secular inflation cannot persist without a corresponding increase in the money supply over and above the growth in real output. In this regard, inflation can only be reduced by slowing down the growth of the money supply. The monetarists are of the believe that, maintaining a stable price level through control of the money supply would take care of economic imbalances and rigidities that occur in developing countries.

The structuralists on the other hand assert that, inflationary pressures can exist independently of monetary conditions. In their view, inflation is due mainly to supply rigidities in key sectors of the economy and so money supply is the effect, rather than the cause of inflation (Pennant-Rea and Emmont, 1990: 118). The structuralists believe that, the direction of causation runs from identified bottlenecks in different sectors of the economy to low output and then to rising prices and finally to increases in the money supply. For instance, bottlenecks in the agricultural sector have an adverse effect on food production, which result in an increase in the prices of food. Cost of living then goes high and this in turn, leads to high money wages.

Similarly, lack of foreign exchange in many developing countries leads to balance of payments deficits, which often results in currency devaluation and import restrictions. Such measures lead to an increase in the prices of imported goods and their substitutes and this has an adverse effect on domestic prices. An increase in the general price level then implies that, the money supply has to be further increased; since the inability to accommodate the price increase will have a negative impact on the recurrent and development expenditures. The structuralists suggest that, to be able to run a modern economy at low inflation, governments need an income policy.

Inflation modelling approaches

A careful study of the literature on the causes of inflation in various countries reveals different inflation modelling approaches. For instance, using a mark-up model to describe inflation processes in Fiji, Dewan et al. (1999)

[2] See Meltzer, Allan, H. The Concise Encyclopedia of Economics. Available at: http://www.econlib.org/library/Eric/monetarism.html (Accessed: 09/02/05)

concluded that, inflation is driven by both foreign and domestic factors in a manner consistent with theoretical models[3]. The International Monetary Fund (IMF) for its part maintains that in the long-run, inflation in developed and developing countries is a monetary phenomenon[4]. Inflation is said to be mainly caused by increase in money supply. Again, Dornbusch et al. (1990: 1-84) conducted a research using Granger causality test and variance decompositions in VAR framework in a more restricted sample consisting of few high inflation emerging markets and found that exchange rate shocks have been the main driving force behind inflation.

In addition, Montiel (1989: 527-549) carried out an empirical analysis of high inflation episodes in Argentina, Brazil and Israel and found that, there was rather little support for fiscal view. The research result suggested instead that, exchange rate shocks have been the main case of inflationary pressures. Furthermore, Agenor and Montiel (1999) have argued that, wage indexation on past inflation rates directly or indirectly play a crucial role in inflation persistence by transmitting exchange rate movements to domestic price.

In support of the structuralist view, Fisher et al. (2000) have indicated that, using a very broad cross-country panel and fixed effect estimates that, fiscal deficits have been a determinant of high inflation. In a similar work, Fisher et al. (2001) found that, the relationship between fiscal deficit and inflation is only strong in high inflation countries but there is no obvious relationship between them for low inflation countries. The lack of relationship between fiscal deficit and inflation could be due mainly to the ability of the government to borrow money from domestic sources. In that respect, the transfer of money from the private to the public sector would not cause inflation.

Again, using an econometric specification explicitly derived from an inter-temporal optimization model that relates long-run inflation to the permanent component of the fiscal deficit. Catao and Terrones (2001) found that one percentage point reduction in the ratio of fiscal deficit to GDP typically lowers long run inflation by one and a half to six percentage points depending on the size of the inflation.

Another work aimed at explaining inflation trends is that by Lim and Papi (1997). In the study, price determinant is analyzed within the broad construction of a multi-sector macroeconomic model. In the study, four sectors namely; goods, money, labour and external markets are assumed to be the only sectors of the economy. The result of the study among others is that, even though money supply plays an important role in determining inflation in Turkey, deficits in the public sector coupled with inertia factors were equally important in explaining high inflation in the country.

In their study, Lougani and Swagel (2001) examined the experience of 53 developing countries by estimating six variable vector autoregressions (VARs). These included money growth, an estimate of the output gap, exchange rate changes, price of oil, non-oil commodity prices and inflation. They found that two- thirds of the changes in inflation is caused by either money growth or exchange rate movements. Additionally, the authors found that inflation expectations play a crucial role in inflation determination, with past realizations of inflation constituting between 10 and 20% of the movements in inflation.

Empirical study of inflation in Ghana

Inflation in Ghana has been substantially researched. Chibber and Shaffik (1991) conducted a study on the effects of bank and fund policy reforms on inflation in selected African countries using regression analysis and concluded that inflation in Ghana was indeed, a monetary phenomenon. In the said study, they noted that devaluation led to a reduction in the rate of monetization and inflation implying that it has a positive impact on government budget.

Contrary to the aforestated assertion, however, Dordunoo (1994) argues that rapid exchange rate depreciation and resultant increases in import prices are the main causes of Inflation in Ghana. Also, with the aid of error correction model, Sowa (1996) estimated an inflation equation for Ghana and concluded that its inflation was influenced more by output volatility than monetary factors.

The study, however, did recognize the significant of money supply on inflation. Again, using causality tests as well as variance decomposition of a vector error-correction model involving money, output and inflation, Akoena (2000) concludes that inflation in Ghana is mainly due to innovations in output. He contends that while changes in money depend both on long-run disequilibrium and short-run changes in Ghana's inflation rate, there is no feedback causality from inflation to short-run changes in money.

In the light of the divergent views regarding inflation in Ghana, there is no gainsaying the fact that, a more generic approach is required to explain the causes of inflation in the country. In other words, we need an approach that is represented by both monetary and structural variables. What is absent in the aforementioned studies is an attempt to model inflation in Ghana using co-integration and ARIMA models. In view of this, our study intends to model inflation in Ghana by making a comparison of co-integration and ARIMA models

METHODOLOGY

Data used in the study consists of monthly data for the period 2000:6 to 2010:12. However the actual sample data used was

[3] Dewan, F. et al. Modelling Inflation Processes in Fiji, Working Paper 99/02, June 99. Available at http://www.researchbank.gov.fj/docs/1990_02_wp.pdf

[4] See IMF publication, October 1996

Table 1. Forecast results of ARIMA.

Horizon	ARIMA
2010-6	3.108
2010-7	3.2988
2010-8	3.634
2010-9	4.0564
2010-10	4.6477
2010-11	5.4633
2010-12	6.3431
2011-1	7.2623
2011-2	8.0332
2011-3	8.0563
2011-4	9.1141
2011-5	9.2133

2000:6 to 2010:4, this is so because eight (8) observations were reserved to be used to compare with the forecast results, (Table 1). The variable used is consumer price index (INFLATION). The data gathered was analysed and tested by using PCGive, Econometric software developed by Doornik and Hendry (2001).

Univariate approach

Making prediction in time series using a univariate approach is best done by employing the autoregressive integrated moving average models ARIMA (p, d, q). These are a set of models that describe the process $\{y_t\}$ as a function of its own lags and white noise process (Box and Jenkins, 1974). Thus, the model specification was based on:

AR (6), $y_t = \mu + a_1y_{t-1} + \dots + a_4y_{t-6} + e_t$ (1)

Where; μ is a constant, e_t is a white noise process and the order of the process is 4

MA (6), $y_t = a_0 + e_t + b_1e_{t-1} + \dots + b_3e_{t-6}$ (2)

Where e_t is a white noise process and the order of the process is 3.

The integrated process is one which needs to be differenced to become stationary.

Thus a process y_t is integrated of order I (d), if it contains no deterministic components, is non-stationary in levels but becomes stationary after differencing d times (Sjöö, 2003). A combination of Equations (1) and (2) yield the ARIMA (6,1,6),

$$\Delta y_t = a_0 + a_1y_{t-1} + \dots + a_4y_{t-6} + e_t - b_1e_{t-1} - \dots - b_3e_{t-6} \quad (3)$$

Using the lag and difference operators the former can be written compactly as;

$$(1-L)^1y_t = a(L^4)y_t + b(L^3)e_t \quad (4)$$

Where (1-L) = Δ difference operator, $a(L^6)$ is the coefficient and lag of the AR(6) model, $b(L^6)$ is the coefficient and lag of the MA(6) model and e_t is an error term, y_t is the series or variable modelled, in this case the monthly INFLATION of Ghana.

We built our ARIMA model by following the Box–Jenkins approach (Box and Jenkins, 1974). This involved the following steps; (1) Identification, (2) Estimation, (3) Testing, (4) Reestimation and Forecasting.

Identification

In other to determine the order of integration of the series to the Autocorrelation and Partial Autocorrelation Graphics would be applied (Sjöö, 2003). In addition, units root tests were conducted using the ADF approach.

Estimation

We estimated our model by using the maximum likelihood estimation (MLE). This generated an efficient and parsimonious model with optimal lag length.

Testing

This was done to determine the optimal lag order of the model so that the residuals become a white noise process. Our choice of the lag length was based on the lowest Akaiki information criteria (AIC). This is given as:

$$AIC = \ln \frac{\sum_{i=1}^{T} \hat{\varepsilon}_i^2}{T-n} + \frac{2n}{T} \quad (5)$$

Where $\hat{\varepsilon}_i^2$ is the estimated squared residuals of the model, T is the number of observations in the sample and n is the number of parameters estimated including the constant (Akaike, 1973).

The Hatemi-J information criterion was also used for confirmation of the test. This criterion is given as:

$$HJC = \frac{P\ln T + 2P\ln(\ln T)}{2T} + \ln\left(\frac{\sum_{t=1}^{T} e_t^2}{T-P}\right)_j \quad (6)$$

Where p is the total number of parameters in the model and T is the sample size. According to Hatemi-J (2003), the last term is the log of the estimated variance of the error term for the lag order j (Table 2).

Re-estimation

This was done to determine if the model specified is a better fit. This process of re-estimation and testing continued until a good statistical model which is parsimonious, with optimal lag length and white noise residual was obtained.

Forecasting

Given the model estimated we forecast y_{t+36}, ie 12- periods ahead forecast. This can be written as $\hat{y}_{t,12}$. t = time period when the forecast is made. 12= forecast horizon.

Thus, given an ARIMA (6, 1, 6) model,

$$\Delta y_t = \alpha_1y_{t-1} + \dots + \alpha_4y_{t-6} + e_t + \beta_1e_{t-1} + \beta_2e_{t-2} + \beta_3e_{t-6} \quad (7)$$

Table 2. Standard errors and estimated variances.

Horizon	ARIMA σ	ARIMA σ^2
2010-6	0.09490	0.00900
2010-7	0.1376	0.01893
2010-8	0.17416	0.03033
2010-9	0.21296	0.04535
2010-10	0.24431	0.05968
2010-11	0.28057	0.07872
2010-12	0.32088	0.10296
2011-1	0.37573	0.14117
2011-2	0.41769	0.17446
2011-3	0.45586	0.20780
2011-4	0.49146	0.24153
2011-5	0.52485	0.27546

To forecast k = 1 period,

$$y_{t+1} = \alpha_1 y_t + \alpha_2 y_{t-1} + e_{t+1} + \beta_1 e_t + \beta_2 e_{t-1} \quad (8)$$

If e_{t+1} is replaced with its expected value of zero we can rewrite equation (8) as

$$y_{t+1} = \alpha_1 y_{t-1} + \alpha_2 y_{t-2} + \beta_1 et + \beta_2 e_{t-1} \quad (9)$$

Thus, Equation 9 can be used to forecast to cover the forecast horizon. The ARIMA approach has been criticised on the grounds that, it is an inefficient procedure for forecasting and explaining a series. This is so because it relies on only information about the history of the series and ignores the potential information in related series. However economic theory is rich in suggestions for relationships between variables. (Johnston and DiNardo, 1997: 205)

RESULTS AND DISCUSSION

Here, an analysis of our test results for the ARIMA model is shown.

Time series properties

Figure 1 shows graphs of the variables in log levels and first difference; LINFLATION, log of consumer price index. Graphs of the variable in log level show trend, however graphs of the variable in first difference show stationary level or no trend though with some outliers (Figure 1).

Units root tests

This test was conducted to determine if the series were integrated of order one I(1) or otherwise. This is very important in Time Series analysis. In furtherance of this, the Augmented Dickey-Fuller (ADF) test was used for the tests. The test is based on the assumption that, a series x_t, is a random walk; $x_t = x_{t-1} + \varepsilon_t$ or $x_t = \rho x_{t-1} + \varepsilon_t$.

where ρ = 1.0 thus x_{t-1} is subtracted from both sides. $\Delta x_t = \pi x_{t-1} + \varepsilon_t$, where $\pi = (\rho - 1)$. (Hatemi-J). The null hypothesis is H_0; $\pi = 0$ and therefore $\rho = 1$ against the alternative that H_1: $\pi < 0$ and $\rho < 1$

The test was carried out first with a constant, then a constant and a trend. In each case the Ho: $\pi = 0$ was not rejected at the 5% (-3.446) and 1% (-4.034) significant levels given the test value of 2.6548. The test statistics was based on the non-standard Dickey-Fuller distributions. However, the number of lags required to remove autocorrelation at the 10% significance level using the LM test was three lags.

ARIMA model

The model specification was based on the Box-Jenkins approach as discussed earlier.

Identification

The model was built by determining the order of integration of the consumer price index series. The series was graphed in levels and it was observed that they were not stationary. By implication, the mean value was not zero and the variance of the series was not constant. In view of the non-stationary nature of the series, the data were transformed in order to make them stationary. Thus, the log and first difference of the series were taken. The second differences of the series were also taken to enable a comparison of the outcome with those of the first difference. By comparing the first and second differences, it was observed that it was better to use the log first difference of the series, so as to build a good model. In other words, the series was an integration of the first order. The autocorrelation function (ACF) and the partial autocorrelation function (PACF) graphs of the log first difference confirm the results of the unit root test as discussed earlier (see Appendix 1 for graphs ACF and PACF).

Estimation

The next step was to estimate the model. In this regard, AR (P) was defined from orders 12 to 1 and a test was conducted to find an optimal lag length. Lag 6, which had the lowest Akaike Information Criteria (AIC) value of -1.47711957 and 8 parameters, was then chosen for the model. After carrying out a test for the AR process, a similar test was carried out for the MA process and the optimal lag length chosen was lag 6 with the lowest AIC value of -1.47410864 and 8 parameters.

Figure 1. Graphs of variable in log levels and first difference.

In carrying out the test for ARMA processes, ARMA (6, 0, 6) was derived with 14 parameters and an AIC value of -1.62542309. However, once the series are integrated of order one as per the results of the unit root test, our model can be stated as ARIMA (6, 1, 6).

Diagnostic test

In the Box-Jenkins approach, testing for white noise is the same as testing for autocorrelation (Sjöö, 2003, p.55). This method suggests that, it is better to start with a relatively large number of lags and test for autocorrelation. In view of this, a test for autocorrelation in the residuals was conducted using the Portmateau test. From the test results, the null of no autocorrelation in the residuals up to lag 4 at the 5% significance level. Thus, 0.0037915, -0.022960, -0.013770, 0.047620 was accepted.

Also, graphs of the residuals show no autocorrelation (Figure 2).

Forecast

A forecast of the variable (inflation) in levels was produced. Therefore, at a confidence interval of 95%, the forecast of inflation falls within the range of; Table 3 Forecast ±1.96*σ. Thus, from the variances of the model, the Root Mean Squared Error (RMSE) can be calculated as:

$$\sqrt{\frac{\sum \sigma^2}{H}}$$

Thus, this can be used to determine the efficiency of the model

Where H is the forecast horizon, the RMSE is

$$\sqrt{\frac{1.385442}{12}} = 0.115453$$

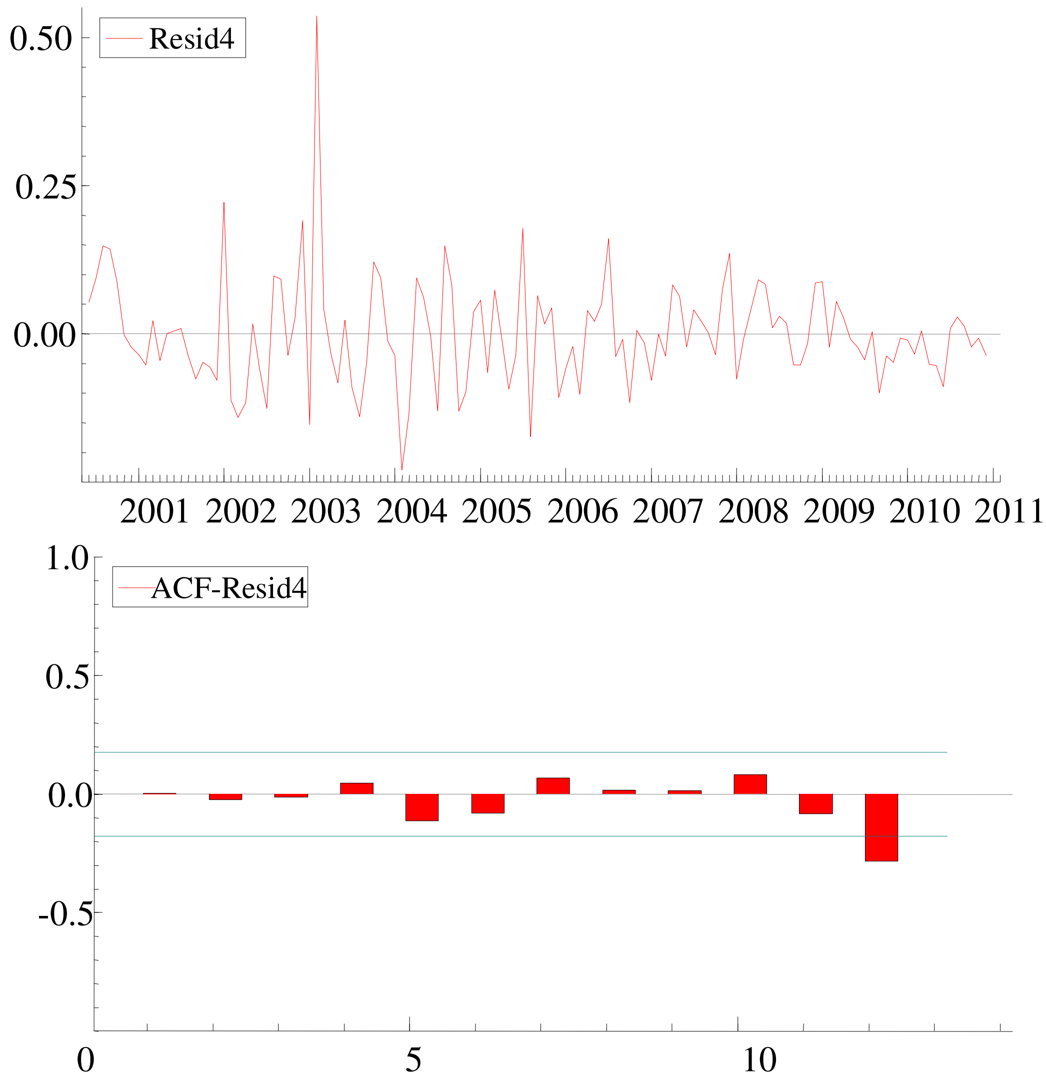

Figure 2. ACF of the Residuals of ARIMA (6,1,6). The graphs show residual plot and ACF graphs of the residuals of

Table 3. Forecast confidence interval.

	ARIMA Model		
	Forecast	**High**	**Low**
2010-6	3.108	3.29401	2.92199
2010-7	3.2988	3.568496	3.029104
2010-8	3.634	3.975354	3.292646
2010-9	4.0564	4.473802	3.638998
2010-10	4.6477	5.126548	4.168852
2010-11	5.4633	6.013217	4.913383
2010-12	6.3431	6.972025	5.714175
2011-1	7.2623	7.998731	6.525869
2011-2	8.0332	8.851872	7.214528
2011-3	8.0563	8.949786	7.162814
2011-4	9.1141	10.07736	8.150838
2011-5	9.2133	10.24201	8.184594

Note: confidence interval used is $\pm$ 1.96, high (+) and low (-).

This implies that, the forecast inflation fall within the range of the confidence interval. From the earlier stated therefore, the forecast inflation is for whole horizon does not deviate significantly from the calculated interval for both models. This suggests that both models have low degree of errors and as such make a reasonable accurate prediction of inflation. We also calculate the volatility of inflation from 2008 - 2007 to 2010-2012. Thus, we calculate the variance (σ^2) of 30 observations of the sample size, we then use this to compare with the variances from the forecast from the model.

$$\sigma^2 = \sqrt{\frac{\sum_{i=1}^{N}(INFL-m)^2}{N}}$$

Where N is number of observations (30),

Table 4. Determining the volatility of inflation.

Period	Inflation	Error	Error^2
31-Jul-08	18.3	2.70626358271745	7.3
29-Aug-08	18.1	2.49246537266427	6.2
29-Sep-08	17.9	2.28405223355632	5.2
31-Oct-08	17.3	1.68951998801046	2.9
28-Nov-08	17.4	1.83122539951277	3.4
31-Dec-08	18.1	2.52658691948477	6.4
30-Jan-09	19.9	4.25082573574985	18.1
27-Feb-09	20.3	4.72901410834936	22.4
31-Mar-09	20.5	4.91852415506466	24.2
30-Apr-09	20.6	4.95288148679404	24.5
29-May-09	20.1	4.45141665559507	19.8
30-Jun-09	20.7	5.13419287009246	26.4
31-Jul-09	20.5	4.89034314295067	23.9
31-Aug-09	19.6	4.04080490005702	16.3
30-Sep-09	18.4	2.76485947330822	7.6
30-Oct-09	18.0	2.43272063519866	5.9
30-Nov-09	16.9	1.31013012803898	1.7
31-Dec-09	16.0	0.36646978789447	0.1
29-Jan-10	14.8	-0.82476962478342	0.7
26-Feb-10	14.2	-1.37188834974327	1.9
31-Mar-10	13.3	-2.28808680944288	5.2
30-Apr-10	11.7	-3.94693733844425	15.6
31-May-10	10.7	-4.92901982644006	24.3
30-Jun-10	9.5	-6.08450097360076	37.0
30-Jul-10	9.5	-6.14812439202106	37.8
31-Aug-10	9.4	-6.16966516788411	38.1
30-Sep-10	9.4	-6.22295682709300	38.7
29-Oct-10	9.4	-6.22513316013024	38.8
30-Nov-10	9.1	-6.53223839144626	42.7
31-Dec-10	8.6	-7.02908694096797	49.4
	468.2	-0.00011122695773	552.4

m is the mean = $\frac{\sum INFL}{N}$

Thus, m = $\frac{468.2}{30} = 15.61$

$$\sigma^2 = \sqrt{\frac{552.4}{30}} = 4.291$$

From the aforestated, it can be stated that volatility of inflation (INFLATION) over 2008-2007 to 2010-2012 has been 4.291 and this indicates a moderate volatility in inflation in Ghana over the period under study. However, this volatility is higher that from the forecast. Table 4

Table 5. Comparison of forecast results with actual observations.

Period	ARIMA	Actual observations
2010-5	3.108	10.7
2010-6	3.2988	9.5
2010-7	3.634	9.5
2010-8	4.0564	9.4
2010-9	4.6477	9.4
2010-10	5.4633	9.4
2010-11	6.3431	9.1
2010-12	7.2623	8.6

Comparison of forecast results

First, we compare eight forecast values from models with the eight actual observations which were set aside as previously stated. The Table 5 shows a comparison of forecast values and actual observations. From Table 5, though the forecast inflation for the horizon are far lower than the actual as the horizon increases then the forecast values get closer to the actual observation. However, a closer study of the variances on Table 4 for the model reveals that, the variances are very low.

Also, given the volatility of inflation as calculated (4.291), suggesting that inflation over the period under study has been moderately volatile. The end of year 2010 actual inflation was 8.6%. However, the forecast inflation for the same period from the forecast values is 7.3%.

SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

Summary

This study aimed at, sought to predicting inflation in Ghana accurately, using ARIMA model. In view of the time series properties of the variables were determined. This enabled ascertaining the order of integration of the series. Therefore, units root test was conducted and the null of the series integrated of order one was not rejected. We finally built an ARIMA (6,1,6) model. In so doing, we were guided by the AIC information criteria and a model devoid of autocorrelation.

Inflation was predicted over 12 horizon, the predicted monthly inflation within the confidence interval of ±1.96*σ at highest was given as 8.95, 10.07 and 10.24 for the months of March, April and May respectively. The Root Mean Squared Error (RMSE) which determines the efficiency of the model was estimated at 0.115453, this indicates that the model built is efficient.

Conclusion and policy recommendations

The forecasts from the model suggests that ARIMA model may be efficient in forecasting or predicting inflation in Ghana after the process has been set in motion as the predictions get closer to the observed values with increases in the horizon. However given the long lag of the model (6,1,6), it can be stated that inflation within 2008-7 to 2010-12 has a long memory (history) and that it can take a period of 12 months to bring inflation to a stable state.

However, an inflationary process must first be set in motion by a (some) variable(s) before past values can be used for forecasting. Again given the current inflation and other information set (past inflation), future inflation is predictable. Thus, inflation as per our model can be likened to a martingale process. It is recommended that the appropriate measures must be put in place to prevent inflation spiral from setting in motion. This so because our model suggests that, inflation has a long memory and that once the inflation spiral is set in motion it will take at least 12 periods (months) to stabilize it.

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