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Modelling and Forecasting Narrow Money in Ghana

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Abstract

Narrow Money is a category of money supply that includes all physical money like coins and currency along with demand deposits and other liquid assets held by the central bank. Narrow money is the most accessible money in an economy, it is restricted to paper currency, coins and demand deposits (money in checking accounts, savings accounts and other highly liquid accounts) and it is also the most liquid form of money. Monthly recorded Narrow Money data between the years 2000 to 2015 were obtained from the Bank of Ghana website. Monthly seasonal Indices are calculated as well as descriptive statistics and fitted ACF, PACF, and time series plot of Narrow Money. By the application of Box -Jenkins method, the data was analyzed and used to identify the best ARIMA model. The model works in stages, first stage is how to identify the appropriate ARIMA model. The second stage is to estimate the parameters of the ARIMA model chosen, the third stage is the diagnostic checking of model and the final stage is where the analysis is based on the model chosen to forecast the future occurrence. The researchers used statistical programs such as R-software and Minitab in the data analysis in the study.

Keywords: ARIMA model**,** narrow money, M0, M1, M2, M3

INTRODUCTION

Narrow Money is a category of money supply that includes all physical money like coins and currency along with demand deposits and other liquid assets held by the central bank. In the United States narrow money is classified as M1 (M0 + demand accounts), while in the U.K. M0 is referenced as narrow money. Narrow money is a colloquial term for the total of a country's physical currency plus demand deposits and other liquid assets held by the central bank. The economic term for narrow money is M1.

Narrow money is the most accessible money in an economy, it is restricted to paper currency, coins and demand deposits (money in checking accounts, savings accounts and other highly liquid accounts) and it is also the most liquid form of money. One measure of the money supply that includes all coins, currency held by the public, traveler's checks, checking account balances, NOW accounts, automatic transfer service accounts, and balances in credit unions is called M1. Modern money has several components. Apart from just cash and coins, money also consists of deposits with the banking system, both interest-free demand deposits and interest-bearing time deposits, such as fixed deposits. The various components of money can be aggregated together in order of liquidity. Since money is primarily used to settle day-to-day transactions, it needs to be readily usable as a means of doing so. Clearly, cash and coins are the most liquid forms of money, since they can be used instantaneously and universally used to settle unlimited transactions. Demand deposits, or accounts with banks, are also quite liquid, as they can be used to write cheques against, in settling daily transactions. The sum of currency in circulation and demand deposits with banks are called M1, or 'narrow money'.

Time deposits, though not as liquid and instantly available as transactions settling medium as M1, they are still money, since it will be available at some point, and very often, as in the case of fixed deposits, can be converted to cash for some penalty. Usually, time deposits are much larger than both currency in circulation and demand deposits. The sum of M1 and time deposits is called broad money. There are different measures of money supply and not all of them are widely used and the exact classifications depend on the country. M0 and M1, also called narrow money, normally include coins and notes in circulation and other money equivalents that are easily convertible into cash. M2 includes M1 plus short-term time deposits in banks and 24-hour money market funds. M3 includes M2 plus longer-term time deposits and money market funds with more than 24-hour maturity. The exact definitions of the three measures depend on the country. M4 includes M3 plus other deposits. The term broad money is used to describe M2, M3 or M4, depending on the local practice.

The concept of Narrow Money is not an entirely new phenomenon in economics but its pace over the last two decades of the twentieth century has thrown up new challenges to perhaps one of economics most hotly debated topics: the demand for money. The empirical study of the demand for money is one of the most popular subjects in applied econometrics (Melnick, 1995). The search for a stable demand for money has been a very contentious issue since the great intellectual debates between Keynesians and Monetarists of the 1960s and 1970s, as no demand for money model set forth by any of these two schools as well as their contemporaries has withstood the test of time. The instability of the demand for money in the 1970s and in the 1980s has been attributed primarily to changes in the performance of financial markets in the area of new financial products arising out of financial innovations. Financial innovation is becoming increasingly important in the 21st century as it poses a serious problem for monetary policy, as with new financial products the ability of monetary policy to be effective diminishes, as it changes one variable vital for effective monetary policy; the demand for money. With new financial products, contractionary monetary policy for instance, targeted at reducing excess liquidity as economic agents can easily move money from less liquid holdings to more liquid packages being offered by financial intermediaries. In the process, undermining monetary policy, the reverse occurs vice-versa. In effect financial innovation has also raised serious problems in the definition and measurement of money. This study seeks to predict the narrow money carried out in Ghana during the period of consideration and to determine the pattern of narrow money in Ghana. There is, and has always been, considerable disagreement among economists over what determines the levels and rates of growth of output, prices and employment.

The aim of the study is to model narrow money in Ghana so as to forecast the future values for the country, Central Bank, the government and the general public as a whole. Specifically, the study is also aimed at:

i. Investigating into the trend of Narrow Money in Ghana using trend analysis.
ii. Determining the pattern of Narrow Money in Ghana using time series plots.
iii. Forecasting three years (36 months) Narrow Money in Ghana using an adequate ARIMA model.

METHODOLOGY

Monthly recorded Narrow Money data between the years 2000 to 2015 were obtained from the Bank of Ghana website. Monthly seasonal Indices are calculated as well as descriptive statistics and fitted ACF, PACF, and time series plot of Narrow Money

By the application of Box -Jenkins method, the data was analyzed and used to identify the best ARIMA model. The model works in stages, first stage is how to identify the appropriate ARIMA model. The second stage is to estimate the parameters of the ARIMA model chosen, the third stage is the diagnostic checking of model and the final stage is where the analysis is based on the model chosen to forecast the future occurrence. The researchers used statistical programs such as R-software and Minitab in the data analysis in the study.

Study population

The study was done in Ghana to measure currency plus demand deposits and other liquid assets held by the central bank. Narrow money is the most accessible money in an economy, which is restricted to paper currency, coins and demand deposits (money in checking accounts, savings accounts and other highly liquid accounts). The population comprises of currency held by the public, traveler's checks, and checking account balances. A detailed analysis of the study area is done in chapter four.

Data collection procedure

The data used for the study is secondary data which was taken from the Bank of Ghana Website. It is a monthly data recorded from the period of January 2000 to December 2015.

Trend analysis

Trend analysis is used if there is trend in the series, no seasonal pattern and it is for long term forecasting. Different trend models could be investigated and the best one selected for the series. The trend may be Linear, Quadratic or Exponential in nature. The Linear, Quadratic and Exponential trend models are represented respectively as

$$\Upsilon_t = \beta_0 + \beta_1 t + e_t \quad (1)$$

$$\Upsilon_t = \beta_0 + \beta_1 t + \beta_2 t^2 + e_t \quad (2)$$

$$\Upsilon_t = \beta_0 * \beta_1^t * e_t \quad (3)$$

The trend with the Minimum Mean Absolute Percentage Error (MAPE), Mean Absolute Deviation (MAD) and Mean Square Deviation (MSD) is the best trend for the series

ARIMA Model

The ARIMA model is a combination of two univariate time series model which are Autoregressive (AR) model and Moving Average (MA) model. These models utilise past information of a time series to forecast future values for the series. The ARIMA model is applied in the case where the series is non-stationary and an initial differencing step can make ARMA model applicable to an integrated stationary process. The acronym ARIMA stands for "Auto-Regressive Integrated Moving Average." Lags of the differenced series appearing in the forecasting equation are called autoregressive terms, lags of the forecast errors are called moving average terms, and a time series which needs to be differenced to be made stationary is said to be an integrated version of a stationary series. A non-seasonal ARIMA model is classified as an ARIMA (p, d, q) model, where p, d, q are integers greater than or equal to zero with p being the number of autoregressive terms, d the number of non-seasonal differences, and q the number of lagged forecast errors (moving average) in the prediction equation. The process should be stationary after differencing a non-seasonal process d times. The ARIMA (p, d, q) is given by;

$$(1 - B)^d y_t = \varphi_0 + \varphi_1 y_{t-1} + \varphi_2 y_{t-2} + \varphi_3 y_{t-3} + \cdots + \varphi_p y_{t-p} + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \cdots + \theta_q \varepsilon_{t-q} \quad (4)$$

Seasonal ARIMA (SARIMA) models

Seasonality in a time series is a regular pattern of changes that repeats over specific time periods. For example every year the pattern of rains in a particular region changes with the months of the year. If S defines the number of time periods until the pattern repeats again, 'S' can be define as S=12 (months per year) or S=4 (quarters per year). It may also be days of the week, weeks of the month and so on. In a seasonal ARIMA model, seasonal AR and MA terms predict Y_t using data values and errors at times with lags that are multiples of S (length of season). Seasonality usually causes the series to be non-stationary because of the seasonal changes in mean. This makes differencing necessary for seasonal data to achieve stationarity. Seasonal differencing removes seasonal trend and can also get rid of seasonal random walk type of non-stationarity. It must also be noted that when the data series has trend, non-seasonal differencing may be applied to "detrend" the data. For this purpose, usually a first non-seasonal difference is enough to attain stationarity, as in the equation

$$(1-B)Y_t = Y_t - Y_{t-1}. \quad (5)$$

When both seasonality and trend are present it may be necessary to apply both a first order non-seasonal and a seasonal difference. In which case the ACF and PACF of the following equation needs to be examined:

$$(1-B^{12})(1-B)Y_t = (Y_t - Y_{t-1}) - (Y_{t-12} - Y_{t-13}. \quad (6)$$

The seasonal ARIMA model incorporates both non-seasonal and seasonal factors in a multiplicative model. The model is written in the following notation: ARIMA (p, d, q) × $(P, D, Q)_S$ Where p, d, q, are the non-seasonal orders AR, differencing and MA respectively. P, D. Q are the seasonal AR order, seasonal differencing order and seasonal MA order respectively. S=time span of repeating seasonal pattern. This model can be written more formally as:

$$\varphi(B)\Theta(B)(1-B)^d(1-B^S)^D y_t = \Theta(B)\Phi(B)\varepsilon_t \quad (7)$$

The non-seasonal components are:

AR: $\varphi(B) = 1 - \varphi_1 B - \varphi_2 B^2 - \cdots - \varphi_p B^p$ (8)

MA: $\theta(B) = 1 + \theta_1 B + \theta_2 B^2 \ldots + \theta_q B^q$ (9)

The seasonal components are:

Seasonal AR: $\Phi(B) = 1 - \Phi_1 B^S - \Phi_2 B^{2S} - \cdots - \Phi_P B^{PS}$ (10)

Seasonal MA: $\Theta(B) = 1 + \Theta_1 B^S + \Theta_2 B^{2S} \ldots + \Theta_Q B^{QS}$ (11)

RESULTS AND DISCUSSIONS

Preliminary analysis

This section explains the descriptive statistics of the data on Narrow Money in Ghana. The maximum and minimum values are 17524 and 121 respectively as shown in Table 1. Also Narrow Money for the entire period was positively skewed and leptokurtic in nature with average and coefficient of variation (CV) being 4658 and 107.34 respectively. Moreover, the Anderson- darling normality test has a p-value less than 0.05, it implies that the data is not normal as shown in Figure 1.

Table 1: Descriptive statistics of Narrow Money in Ghana

Variable	Mean	Min	Max	CV (%)	Skewness	Kurtosis
Narrow Money	4658	121	17524	107.34	1.22	0.30

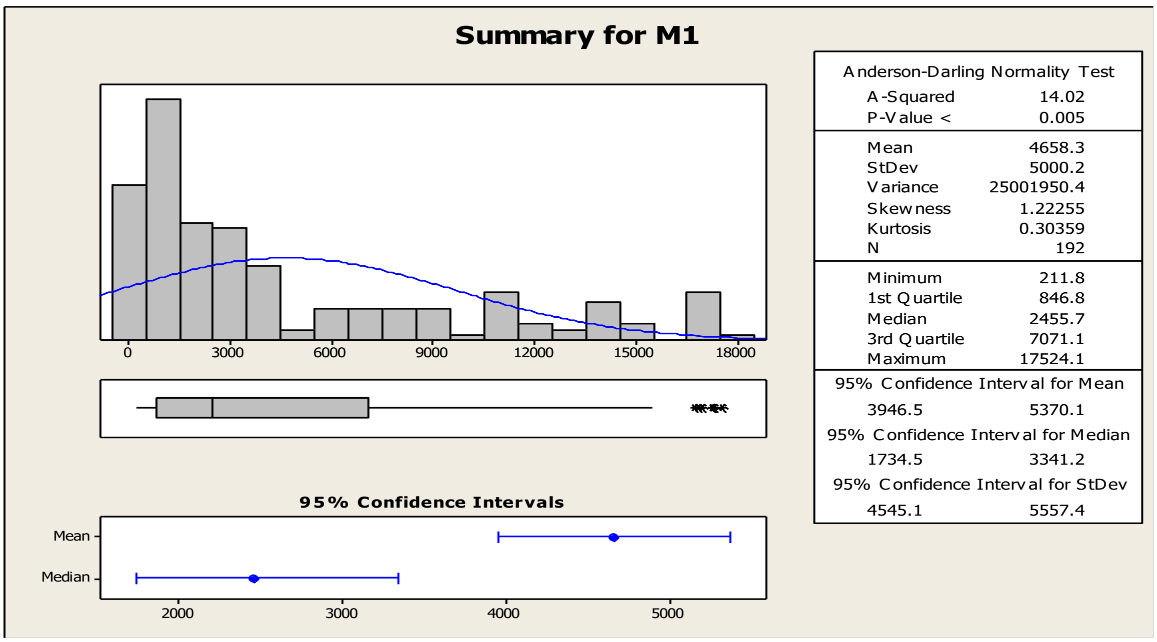


Figure 1: Graphical summary of descriptive statistics

Trend analysis

An investigation into the nature of trend in the Narrow Money was carried out with quadratic, linear and exponential trend models as shown in Table 2. The exponential growth model was observed as the best since it has the least MAPE, MSD and MAD values. Therefore the fitted model is given as

$$\mathrm{NM_t} = 264.199 * (1.02298 ** time) \quad (12)$$

Table 2: Trend analysis of Narrow Money in Ghana

Models	**Measures of accuracy**		
	MAPE	**MAD**	**MSD**
Linear	161	1856	4900589
Quadratic	52	605	564220
Exponential Growth	**9***	**319***	**410037***

*: Best based on model selection criterion

Model identification

The model development process begun with studying the original plot, ACF, PACF and objective test of the raw data to be sure that it is stationary. The time series plot indicates that there are significant increases in the values which depicts an exponential growth based on the nature of the curve. The results is shown in Figure 2. In Checking for stationarity of the data**,** from Table 1, the descriptive statistics revealed that there were large swings in the data indicating non-stationarity. This can be seen from the coefficient of skewness and kurtosis of 1.22 and 0.30. The non-stationarity of the series can be affirmed from the slow decay of the ACF plot as shown in Figure 3. It is therefore necessary to difference the data before pursuing the analysis.

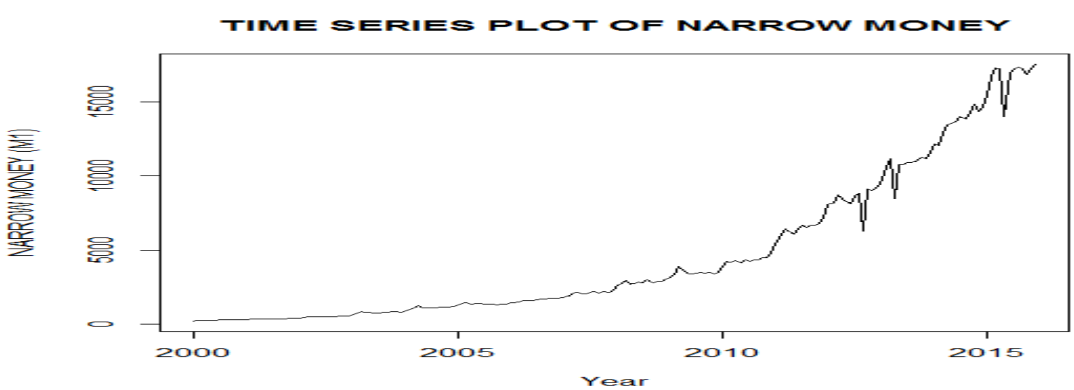
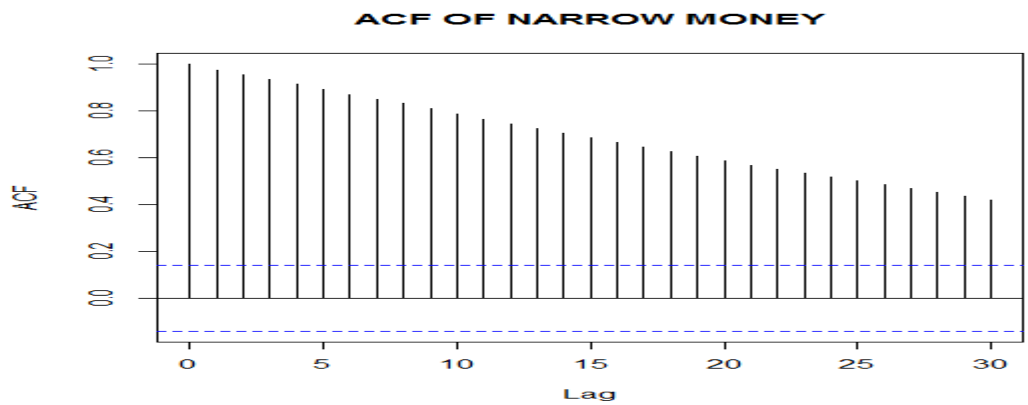


Figure 2: time series plot of Narrow Money



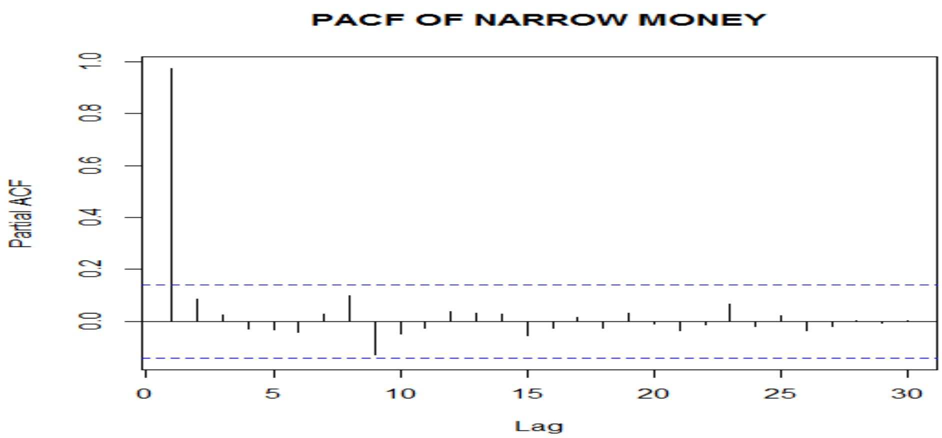


Figure 3: Correlogram and partial Correlogram for the series

To confirm proper ordering of differencing filter, a unit root test was performed. Using the KPSS test, we test the null hypothesis that the original series is stationary. From the test results as shown in Table 3, since the p-value which is 0.01 is less than the alpha (α) value we reject the null hypothesis that the original series is stationary. The ADF confirms the existence of unit root under a situation. This implies that the data needs to be differenced. The results of the KPSS and the ADF test are shown in Table 3.

Table 3: Unit Root and Stationarity test of the series

Test type	Test Statistic	Lag order	Alpha value	P-value
KPSS	4.0687	3	0.05	0.01
ADF	0.9462	5	0.05	0.99

To confirm proper stationarity of the first differenced series, a unit root test was performed. Both the KPSS test and ADF test confirms the non-existence of unit root hence the first differenced series is stationary. This is shown in Table 4.

Table 4: Unit Root and Stationarity test for first differenced series

Test type	Test Statistic	Lag order	Alpha value	P-value
KPSS	1.0626	3	0.05	0.1
ADF	-8.5426	5	0.05	0.01

The results in Figure 4.6, indicates that there is clearly evidence of seasonality in the series. Thus the series was transformed using a 12 month-Ratio-Moving Average (RMA) in order to stabilize the variance and determine the seasonal indices to de-seasonal the data and forecast Narrow Money within each month in a year. Below is the results of the seasonal indices and their corresponding de-seasonal values as well as their percentage explained above or below the normal (100%) within various months in the year shown in Table 5.

Table 5 Seasonal indices for Narrow Money in Ghana

Months	Seasonal indices	Percentage effect
January	0.9989	-0.11%
February	1.0487	4.87%
March	1.10670	10.67%
April	1.06374	6.37%
May	1.0126	1.26%
June	1.0083	0.83%
July	0.9948	-0.52%
August	0.9797	-2.03%
September	0.9556	-4.44%
October	0.9524	-4.76%
November	0.9284	-7.16%
December	0.9502	-4.98%

From Table 5, the results depicted that, the country experiences higher Narrow Money in the months February to June above the normal Narrow Money with percentage values 4.87%, 10.67%, 6.37% , 1.26% and 0.83% respectively. The rest of the months experienced Narrow Money below the normal as shown in the table above.

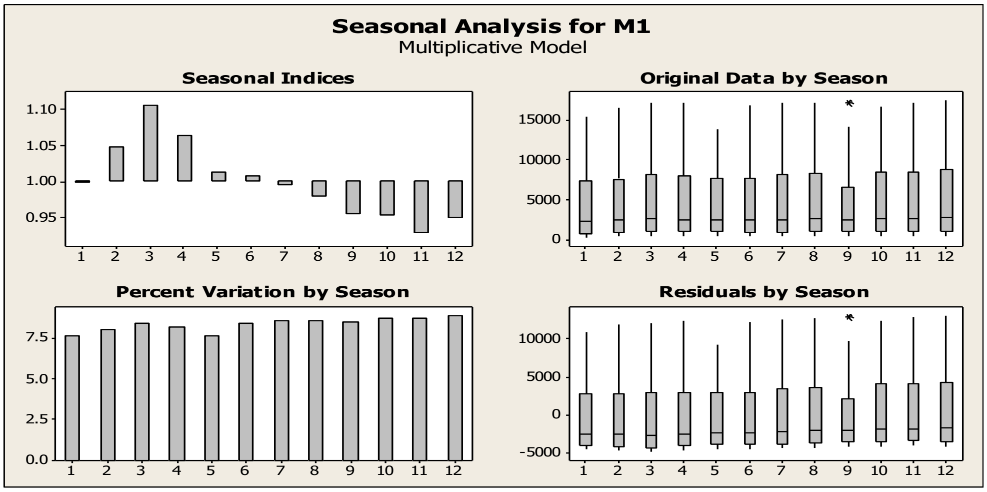


Figure 4: Plot of seasonal analysis of the series

The significant spikes in the ACF at lag 1 of the differenced series is suggestive of an MA (1). There are three significant spikes in the PACF suggesting a possible AR (3) term. However any significant spikes in the ACF and the PACF is due to chance. The pattern in the ACF is indicative of a simple model. From these plots, ARIMA (P, 1, Q) has been identified. Consequently, this initial analysis suggests that a possible model for these data is an ARIMA (3, 1, 1). We fit this model, along with some variations on it, and compute their AIC, AICc and BIC values. The plots are shown in Figure.5 and Figure 6 below.

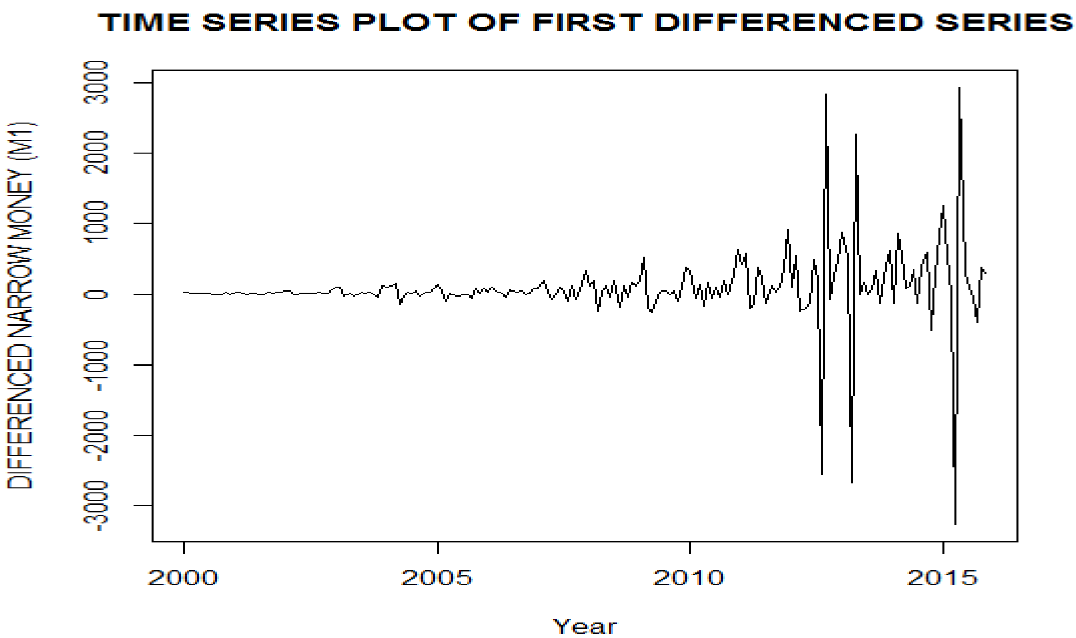


Figure 5: Time series plot of difference series

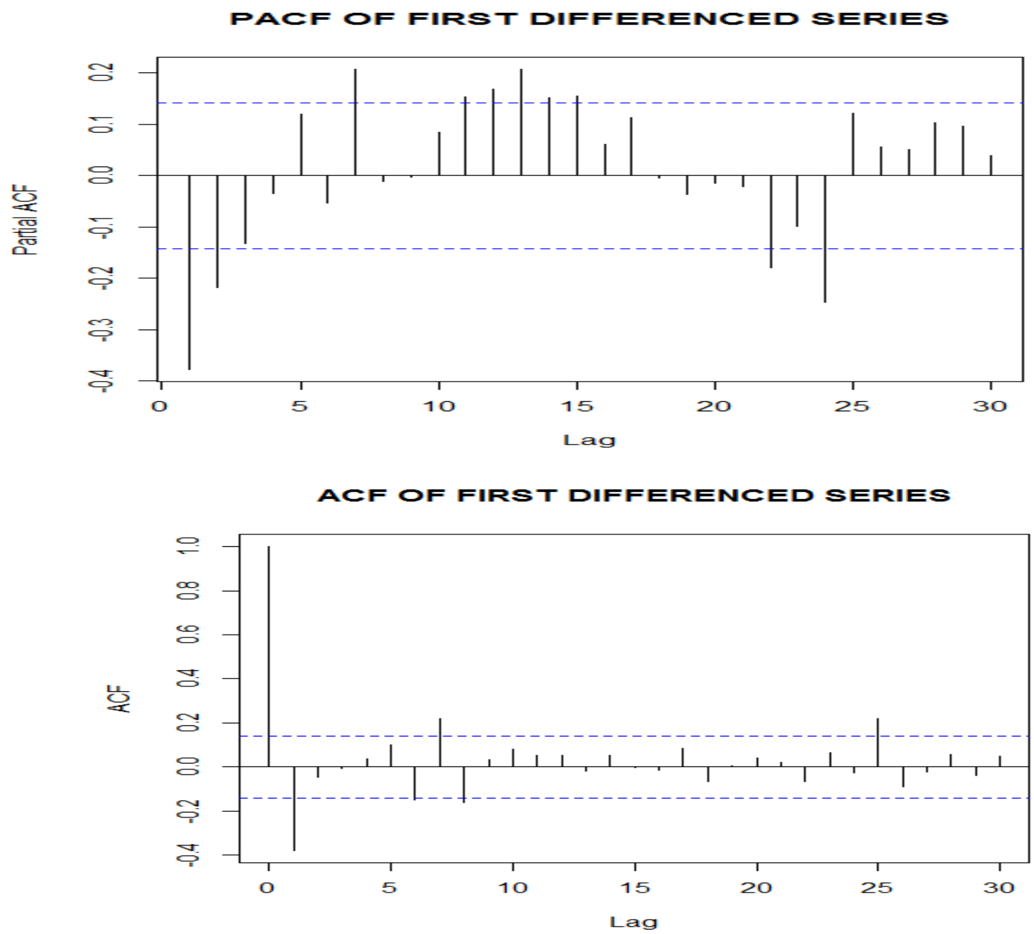


Figure 6: Correlogram and partial Correlogram for first difference series

Model estimation and Evaluation

ARIMA models are usually estimated after transforming the variable under forecasting into a stationary series. The procedure for choosing these models relies on choosing the model with the minimum Akaike Information Criterion (AIC), Modified Akaike Information Criterion (AICc) and Normalized Bayesian Information Criterion (BIC). Among the possible candidate models, ARIMA (1, 1, 1) was chosen as the adequate fitted models for the data since its AIC, AICc, BIC are smaller as compared to the other models. Table 6 displays the candidate models after several combinations of AR and MA terms.

Table 6: Tentative ARIMA Models for the series

Models	AIC	AICc	BIC
ARIMA(0,1,1)	432.71	460.08	475.33
ARIMA(0,1,2)	455.96	459.06	780.83
ARIMA(1,1,1)	**412.22***	**423.75***	**479.97***
ARIMA(1,1,2)	456.92	459.62	480.79
ARIMA(2,1,0)	456.31	465.21	489.30
ARIMA(3,1,1)	423.45	463.15	484.32

*: Best based on the selected criterion

To determine whether the selected model provides reasonable explanation for Narrow Moneyal mortality, the estimates of the coefficients of the parameters of the selected ARIMA model are shown in Table4.7. All the coefficients of the ARIMA (1, 1, 1) model are significantly different from zero at 95% confidence level, hence the estimated values satisfy the stability and invertibility conditions.

Table 7: Parameter estimates of ARIMA (1, 1, 1)

Type	Coefficients	Standard error	T-value	P-value
AR(1)	0.1704	0.5753	2.2217	0.0110
MA(1)	0.8690	0.8980	9.0204	0.0000
		σ^2 =2.4451		

Model Diagnostics (Goodness of fit)

The estimated model must be check to verify if it adequately represents the series. Diagnostic checks are performed on the residuals to see if they are randomly and normally distributed. An overall check of the model adequacy was made using the Ljung-Box Q statistics. Furthermore, Jarque Bera test and Shapiro Wilks test was used to confirm the normality of the residuals and again an ARCH LM-test for conformity of the presence of, or otherwise ARCH effect was performed. The greater p-values in the Ljung-Box test confirms that there is no serial correlation in the residuals of the model Since the p-values are all greater than the alpha (α) value, hence the model is adequate. The results of the Ljung-Box test is shown in Table 8

Table 8: Ljung-Box test statistic for model diagnostics

Lags	Test statistic	P-value
12	12.4149	0.2195
24	37.7673	0.1442
36	41.2327	0.0844
48	64.7676	0.0802

The ARCH LM test in Table 9 indicates that there is clearly evidence of heteroscedasticity in the model residuals, since the p-values are all greater than the alpha (α) value. This makes the model adequate for predictions.

Table 9: ARCH-LM test of residuals of ARIMA (1, 1, 1) of the series

Lag	Chi-square	Df	P-value
12	8.9209	12	0.7097
24	19.4524	24	0.7275
36	29.0896	36	0.7862
48	35.1220	48	0.9169

The Jarque Bera test and Shapiro Wilks tests are used to test the null hypothesis that the residuals follow a normal distribution against the null hypothesis that the residuals does not follow a normal distribution. From Table 10, the normality tests confirmed that the residuals are normal since its p-values are greater than the significant level.

Table 10: Normality Test for Residual of Narrow Money

Normality test	Test statistic	P-value
Jarque Bera	0.9385	0.6255
Shapiro-wilk	0.9904	0.2676

To determine whether the selected model provides reasonable explanation for Narrow Money, the estimates of the coefficients of the parameters of the selected ARIMA model are shown in Table4.7. All the coefficients of the ARIMA (1, 1, 1) model are significantly different from zero at 95% confidence level, hence the estimated values satisfy the stability and invertibility conditions. In time series modelling, the selection of a best model fit to the data is directly related to whether residual analysis is performed well. One of the assumptions of ARIMA model is that, for a good model, the residuals must follow a white noise process. That is, the residuals have zero mean, constant variance and also uncorrelated. Figure 4.7, reveals that the residuals of the model have zero mean and constant variance. Also the ACF of the residuals depicts that the autocorrelation of the residuals are all zero, that is to say they are uncorrelated. Finally, the p-values for the Ljung-Box statistic in the third panel all clearly exceed 5% for all lag orders, indicating that there is no significant departure from white noise for the residuals. Thus, the selected model satisfies all the model assumptions. Since our model ARIMA (1, 1, 1) satisfies all the necessary assumptions, we can say that the model provide an adequate representation of the data.

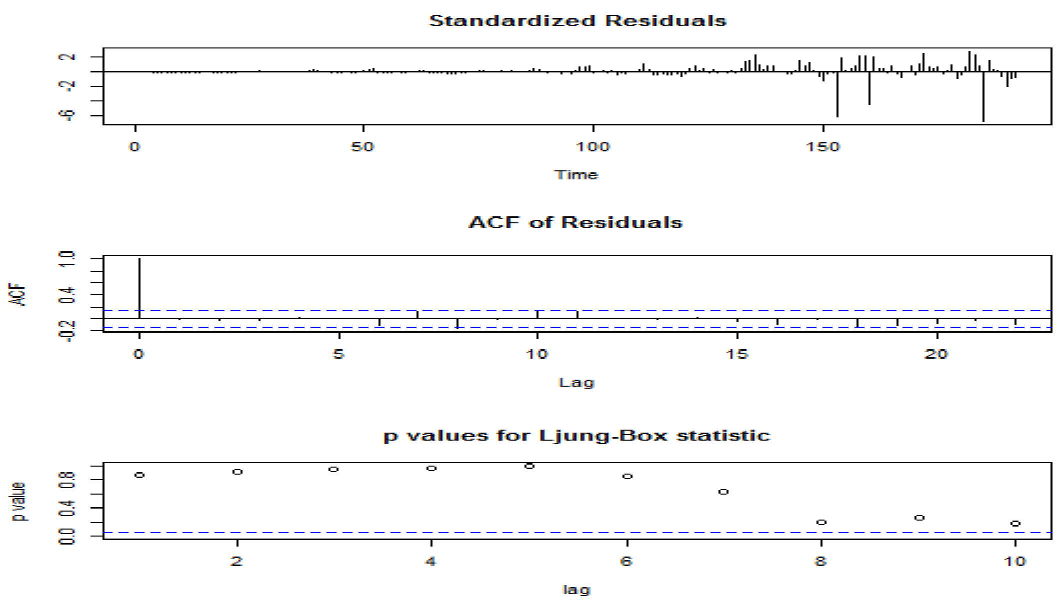


Figure 11: Diagnostic plot of ARIMA (1, 1, 1) of Narrow Money

Forecasting

Future is highly uncertain but most people view the future as consisting of a large number of alternatives. Forecasting is the best way of examining the different alternatives, identifying the most probable ones and thus reducing the uncertainty to the least. Forecasting is the best designed tool to help decision making and planning in the present (Walonick, 1993). So we now have an ARIMA model that passes the required checks and is ready for forecasting. Forecasts from the ARIMA (1, 1, 1) model for the next two years are shown in Table 11.

DISCUSSION OF RESULTS

The results of the study clearly indicates that, the Narrow Moneyal mortality was asymmetric and leptokurtic. This lack of symmetry can be attributed to the large swing in the data set. The leptokurtic nature of the distribution also revealed that, the data sets are clustered around their average value. Clearly the results revealed that, the data follows an exponential trend based on the measures of accuracy. The model development process begun by studying the original plot, ACF, PACF and objective test of the raw data to be sure that it is stationary. The relevant features from Figure 4.6 is that, the mean appears to be non-stationary over the time period. Since the mean was changing, the non-stationarity needed to be removed differencing once or twice so that, the process may be made stationary. However, as it stands now the data is said to be non-stationary in mean and in variance. Also, Kwiatkowski-Phillips-Schmidt-Shin (KPSS) and Augmented Dickey- Fuller (ADF) test were performed. KPSS test is used for verifying whether or not the series is stationary, while Augmented Dickey-Fuller test is used for verifying whether or not there is unit root. From Table 3, the p value of the KPSS test is less than the printed p-value (0.01), so it rejects the null hypothesis that data is level stationary. This indicates that we may regard the time series to be non- stationary. While the p-value of the ADF test is greater than printed p-value, so it fails to rejects the null hypothesis that data has a unit root. Stationarity implies a type of statistical equilibrium or stability in a data. Most probability theories of time series is concerned with stationary time series and for this reason the time series analysis often requires one to turn a non-stationary series into a stationary one so as to use this theories. The series was differenced once and from Table 4, above, we found the differenced series to be stationary and there is no unit root.

We also plotted the graphs for sample autocorrelations function and sample partial autocorrelations function. Figure 9, consists of plots of the ACF and the PACF for the differenced series. These two plots are useful in determining the autoregressive terms and the lagged error terms for both seasonal and non-seasonal components. Looking at the sample ACF and PACF plot of the first differenced series in Figure 9, we apply the Box-Jenkins approach to choose the values p and q. Generally, we build an ARIMA model and compare the AIC, AICc and BIC of all the possible models and find out a model to fit the data better than others, which is the one with the lowest AIC, AICc and BIC values. The models are presented in Table 7 with their corresponding values of AIC, AICc and BIC. Among those possible models, comparing their AIC, AICc and BIC as shown in Table 7, ARIMA (1, 1, 1) was the appropriate model that fits the data well. Using the method of maximum likelihood, the estimated parameters of the model with their corresponding standard errors are shown in Table 7. Therefore at 95% confidence level, we conclude that all the coefficients of the ARIMA (1, 1, 1) model are significantly different from zero and the estimated values satisfy the stability condition.

In time series modelling, the selection of a best model fit to the data is directly related to whether residual analysis is performed well. One of the assumptions of ARIMA model is that, for a good model, the residuals must follow a white noise process. That is, the residuals have zero mean, constant variance and also are uncorrelated. From Figure 11, the standardized residual reveals that the residuals of the model have zero mean and constant variance. Also the ACF of the residuals depicts that the autocorrelation of the residuals are all zero, that is to say they are uncorrelated. Finally, the p-values for the Ljung-Box statistic in the third panel all clearly exceed

5% for all lag orders, indicating that there is no significant departure from white noise for the residuals. Thus, the selected model satisfies all the model assumptions. Since our model ARIMA (1, 1, 2) satisfies all the necessary assumptions, we can say that the model provide an adequate representation of the data.

CONCLUSIONS

Narrow Money is one of the most sensitive indicators of the economic disparity between richer and poorer nations, the Health of a pregnant woman is very significant in the growth of our economy thus calling for major attention. The main research objective was to model Narrow Money in Ghana so as to forecast future occurrence. Based on findings from the study, there is an indication that Narrow Money in the country had experienced an increasing exponential trend from the year 2000 to 2015. We explored the feasibility of an Autoregressive Integrated Moving Average (ARIMA) model developed through the application Box-Jenkins methodology to model the pattern and make forecast for the future. The overall ARIMA model obtained was ARIMA (1, 1, 1) which under all test has proven worthy, we also conclude that, the model is adequate for predictions.

Comparing the predicted Narrow Money with the observed Narrow Money, we can see that the predicted values are close to the true values recorded. Also, these observed values fell within the confidence interval. We then conclude that the forecast values are adequate

RECOMMENDATIONS

From our results and discussions we make the following recommendations to stakeholders:

i. The time series model should be adapted and use for monthly forecasting. This should continuously be updated for forecasting.
ii. The model indicates that the pattern of Narrow Money is increasing exponentially. Such a revelation is critical for monitoring and evaluating the existing interventions, advance plans should be put in place to enhance the circulation of Narrow money during those periods below the average circulation to ensure total achievement in the country's economic and financial policies.
iii. Although the ARIMA model adequately fits the data and is useful for predicting future Narrow Money, it is not recommended for medium and long term predictions. We therefore recommend that future studies should look at other models which have the ability to do medium and long term predictions.
iv. Finally, this study limited itself to analyzing Narrow Money in the country regardless of its determinants. We advocate that further studies should be carried out into the actual determinants of Narrow Money in the country.

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