MODELING SALES OF LIFE INSURANCE IN THE INSURANCE COMPANIES USING TIME SERIES ANALYSIS

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Abstract – The research paper investigates the trend of the sales of the insurance companies' products within the Bolgatanga municipality. Time series analysis was conducted on a historic data of sales of the insurance products for six consecutive years, from 2013 to 2018. Box-Jenkins methodology was employed in the study. The study revealed that sales of the insurance companies was best described by quadratic trend and ARIMA(0,2,3). The findings further revealed that, there were significant performances of sales of insurance products between years and among various insurance products within the municipality. The research paper concluded that sales of the insurance products are likely to stagnate in the future as indicated on the forecasted curve. The insurance companies need strategic marketing techniques to help market their products in order to increase sales of their products.

Keywords: Autocorrelation Function, Partial Autocorrelation Function, Stationarity, Parameter Estimation, Parsimonious model and Differencing, Time Series Analysis, Linear trend model and Quadratic trend model,

Introduction

The insurance industry in Ghana dates back to pre-independence era. The few companies then, were foreign owned. The industry has gone through transitions all intended to revamp the industry. Despite that, much is yet to be achieved in terms of growth. Enterprise insurance, then, Royal Guardian Company was the first insurance company to be set up in 1924). Cenfri, 2018). The state set up the State Insurance Company (SIC) as a national insurance company. Consequently, the National Insurance Commission was established to supervise the industry after coming in force of the Insurance Law,1989 (PNDCL 227).

The insurance industry has become a key player in the financial sector and contribute significantly to Gross Domestic Product (GDP) of economies of most developing and developed countries. Emerging economies like India has a penetrating level of 4% accounting to GDP in 2011. This saw an increase by 1.2% to 6% in 2012 (Barik, 2012). Countries like South Africa accounted for (14.8%), Namibia (7.3%), Malaysia (4.8%), Kenya 2.8), Nigeria (0.6%) to GDP (Swiss Re Sigma Report, 2012). Ghana is yet to make a major inroad into the market (NIC, 2012). Currently, the number of insurance companies operating stands at 24 (life insurance) and 27 (non-life insurance). Even with this number, much is yet to be realized in terms of the level of penetration. The insurance industry in Ghana recorded a very low penetration with a 2% contribution to GDP (NIC, 2016). This fell to 1.2% in 2017 with a penetration of 30% (NIC, 2017). With the current rate of growth of the Ghanaian economy, it is expected that when the right decisions and policies are put in place the sector will record a boost.

Life insurance industry saw an improved growth shifted towards protection and fee-based business. Globally, life insurance premium growth recorded a marginal increase in 2017 as against 2016. This was due mainly to low interest rates. Despite this, as of 2016, emerging markets were tipped to double their penetration in 2017 due to an

increase in protection products, even though 'sharp' regulatory measures were taken at product sales and sales quantity (Global insurance review, 2017). During that period, non-life insurance industry also saw an improvement by a record of 2.8% due to improvement in macroeconomic climate. This paper seeks to build a model for forecasting life insurance in the Ghanaian insurance industry. The outcome will be an addition to documentary evidence of life insurance patronage in the insurance industry.

Literature Review

Making life insurance attractive

There has been a clarion call for people to invest in insurance as a means of mitigating risk that cannot be envisaged. Despite that, the patronage has not been very encouraging. The industry in Ghana is yet to record a meaningful penetration. The insurance sector has been criticized for not keep faith with prospective clients. Like any product, satisfaction and trustplay a key role in attracting customers. No service firm can survive without the customer (Thapa, 2010), and therefore, efforts need to be made to maintain and induce more customers. Customers look out for products and services that gives the best satisfaction (Parasuraman, Berry &Zeithaml, 1991). 1nsurance companies should deliver services and products that will satisfy customers. Front line employees (sale persons) of insurance companies should deliver to the expectation of customers. Failure to do so will make customers withdraw and propagate negative information to others. Customers' challenges should be addressed promptly to foster loyalty (Nyer, 2000). Factors that lead to customer satisfaction and need attention in life insurance include but not limited to "corporate image, service quality and perceive value." (Nguyen et al., 2018). The development of a strong and devoted workforce and the introduction of new products is a sure way of boosting the level of insurance penetration (Negi and Kaur, 2010).

Empirical Evidence

Researchers have made attempt to investigate the insurance penetration in the industry and challenges it faces. Studies by Baldwin et al., (2008), tells of a decline in insurers operating in the United States of America. Olayungbo and Akinlo (2016) found in his studies of some African countries that there is a positive relationship in insurance penetration and economic growth for Egypt. They found also that Kenya recorded a short-run negative effect and a long run positive effect. Boadu et al., (2014) posit that it had been difficult to convince people to patronise insurance product mainly due to the general perception that insurance firms fail to readily settle claims when they are due. They wereof the view that much can be done in the sale of insurance products when sales personnel are well trained and motivated. The reduction of premiums will see more people enrolling unto life insurance (Sarkodie and Yusif (2015)

Even though insurance industry has contributed significantly to the financial sector and the stock markets, not much can be said of the insurance industry (Olayungbo and Akinlo, 2016**).** Insurance can be categorized into life and non-life insurance. The key players are insurers (insurance firms) and policy holders (the insured)

Statistics from the United States of America (USA) has shown that there is a decline in life insurers operating (Baldwin et al., 2008). It is envisaged however, there is growth prospects for the industry. Africa exhibited 12% growth in life premium and 2.1% in non-life in 2013 (Insurance Industry Survey 2015 – Nigeria). Trend analysis by Sibindi (2015) on ten African countries on insurance markets revealed that the insurance markets in Africa ranks least in the world except South Africa. Africa and for that matter need to back up in other to make strides in the global insurance market.

Objectives

This study seeks to achieve the following objectives;

1.To determine the trend of sales of the insurance products (life insurance) in the municipality
2.To develop an appropriate model for sales of the insurance products in the Municipality
3.To make five year forecast of sales of the insurance products in the Municipality
4.To determine whether the products of the insurance companies are significance within the municipality
5.To determine whether sales of the insurance companies are significance over the years 2013-2018

Research Methods

This section deals with, study variables, data source, estimate of ARIMA models, and unit root test.

Study variables

Sales of insurance products are the variables considered in the research study.

Source of data

Data covering six years (2013-2018) was obtained from the insurance companies and customers within the Bolgatanga municipality.

Box-Jenkins methodology

The Box-Jenkins methodology (Box & Jenkins, 1976) is a step by step method of data analysis and construction estimating models which signifies a time series. This technique of estimating models by implements knowledge of autocorrelation analysis based on autoregressive integrated moving average models. This methodology makes great use of historical time series data. It is logically and statistically accurate and increase predicting accuracy. The procedure is of four distinct stages namely; Identification, Estimation, Diagnostic checking and Forecasting.

RESULTS AND DISCUSSION

The results cover the outcome of the various statistical procedures used in analyzing the data collated and coded. It serves as the foundation for interpretation, discussion and drawing of conclusion for the purpose of achieving the research objectives.

Table 1 shows summary of statistics

Sales	
Mean	67.16362939
Median	57.485
Mode	50
Standard Deviation	47.35281494
Sample Variance	2242.289083
Kurtosis	24.71533133
Skewness	3.848362877
CV	70.50365707
Range	500
Minimum	0
Maximum	500
Sum	122506.46
Count	1824
Confidence Level(95.0%)	2.174552582

From table 1, 0(zero) was the minimum value and 500 Ghanacedi was found to be the maximum amount paid for purchasing an insurance product whilst 67.16362939 was the average amount paid for purchasing a product with a standard deviation of 47.35281494 ghanacedis, which denote that sales of the insurance products are widely spread over the mean. The most frequently amount used in purchasing an insurance product is 50 ghanacedi and that of the median amount found to be 57.485 Ghanacedi. For the period of 2013 to 2018 the insurance companies were able to generate an amount of 122,506.46 Ghanacedi.The distribution of the sales of the

insurance products exhibits positive skewness of 3.848362877 which shows that most of the sale of the insurance products are centered on the right of the mean and 24.71533133 of the kurtosis value shows that the sales of the insurance products have heavier tails than normal peak.

COMPARING OF SALES PRODUCTS OF THE INSURANCE COMPANIES

Table 2: One-way ANOVA: sales versus product

Source DF SS MS F P
Product 12 509702 42475 21.50 0.000
Error 1811 3577991 1976
Total 1823 4087693
S = 44.45 R-Sq = 12.47% R-Sq(adj) = 11.89%

Table 2, shows that there is a significantdifference in the sale of the insurance products as affirm by p-value 0.000 is less than 0.05. Turkey method was employed further to determine which product actually contributes to the difference in the sales of the insurance products.

Table 2: Grouping Information Using Tukey Method

product N Mean Grouping
wpp 709 78.46 A
clp461 77.70 A
sw25 75.60 A B
clpp 4 72.50 A B C D E F
wmp 137 65.00 A B
she 9 61.56 A B C D E F
cl 81 53.09 B C D E F
cllp2 50.00 A B C D E F
cb 82 44.90 B C D E F
sehc 91 41.77 F
cbp 73 36.03 E F
fpp41 34.73 D E F
ehc109 31.93 C D E F

In order to determine the products that contribute the differences, a further analysis was conducted using turkey method. For interpretation purposes, the Mean that do not share a letter are significantly different. Thus, the products that contributes significantly to the differences among the products arewpp, clp and sehc. It can be further established that product wpp recorded the highest average amount of 78.46 and that of product ehc recorded the least average amount of the sales.

Figure 1: individual value plot of sales and products

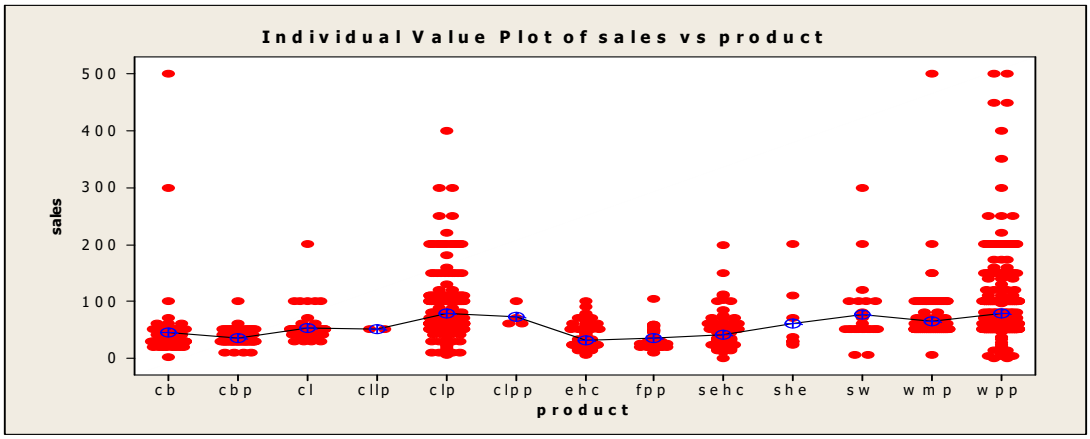


Figure 1 shows that most of the populace are interested in product wpp and therefore, tend to purchase 500 Ghanacedi as premium. This implies that to raise the total premium for the product, the insurance companies should intensify education on the product for more people to patronise it.

SALES PERFORMANCE OF INSURANCE COMPANIES over the period 2013-2018

The researchers sought to ascertained whether the sales of the insurance companies differ from year to year by comparing sales between 2013 to 2018.

Table 4: Summary of year versus year sales

Groups	*Count*	*Sum*	*Average*	*Variance*
2013'	109	5305.21	48.67165	1315.3137
2014'	363	19460.47	53.61011	1968.14632
2015'	390	21430.2	54.94923	735.836273
2016'	430	30026.12	69.82819	1782.14442
2017'	280	22954.92	81.98186	3693.0555
2018'	252	23329.54	92.57754	3038.22198

Table 5: ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	389433.7	5	77886.74	38.2877659	1.85E-37	2.21902
Within Groups	3698259	1818	2034.246			
Total	4087693	1823				

Table 4 and table 5, shows that the year 2018 recorded the highest average, amounting to 92.57 Ghanacedi, and that the least average amounted to 48.67 Ghanacedi which was recorded in the year 2013. Though most of the average amounts are closely related, the overall analysis indicated that there is a significant difference in the sales of the insurance products over the period between2013 to 2018. This implies that the sale of the insurance products differs from year to year as clearly indicated by the average sales of the products and also depicted an increasing trend. The trend in the sale of the products which shows an upward increase can be attributed by high performance of the sales executives over the years

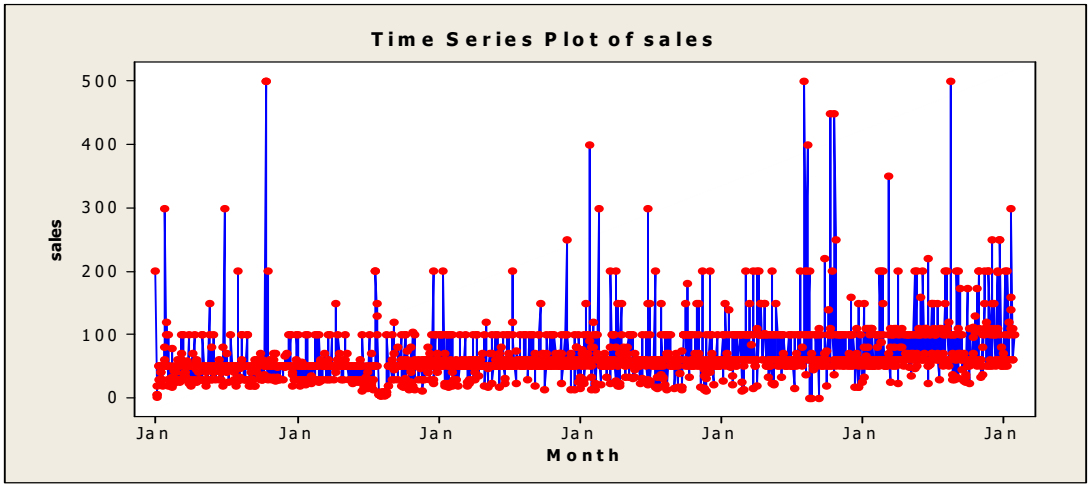


Figure 2: shows Time series plot of sales

Figure 2 however, indicate that sales of the insurance products exhibited increasing and decreasing pattern over the period of time. The overall picture of figure 2 indicates that the series or sales values are not stationary.

Table 6: Stationary test

Test	TEST STATISTIC	P-VALUE
ADF	-25.408	0.01
KPSS	0.010966,	0.1

The stationarity test was conducted to ascertain the claim in figure 2 and the results tend to be true suggesting the series were not stationary. In order to achieve stationaritycondition, the series was difference twice in order to achieve the stationarity.KPSS test results in table 8 clearly shows that the series is stationarysince the p-value (0.1) is greater than 0.05. However, the ADF test with a reverse null hypothesis indicates that the data is stationary with p-value 0.01. In conclusion, the two tests agreed that the series is stationary.

Trend analysis

Determining the behaviour of the series is paramount to identifying the trend model that best describe the behavior of the series. Some of these models are linear, quadratic or exponential. In order to identify the model that best described the series, researchers often use the minimum values of the measures accuracy such as MAPE, MAD and MSD in the selection criterion.

Trend Models

- Linear Trend Model; is estimated using the Ordinary Least Square estimation with a general model of $y_t = \beta_0 + \beta_1 t + e_t$

  Where y_t is the projected value of the y variable for a selected value of t, β_o is the constant intercept; β_1 represents the average change from one period to the next.

- Quadratic Trend Model; which accounts for a simple curve is of the form

  $y_t = \beta_0 + \beta_1 t + \beta_2 t^2 + e_t$

- Exponential Growth Trend Model; accounts for exponential growth or decay. Mathematically,

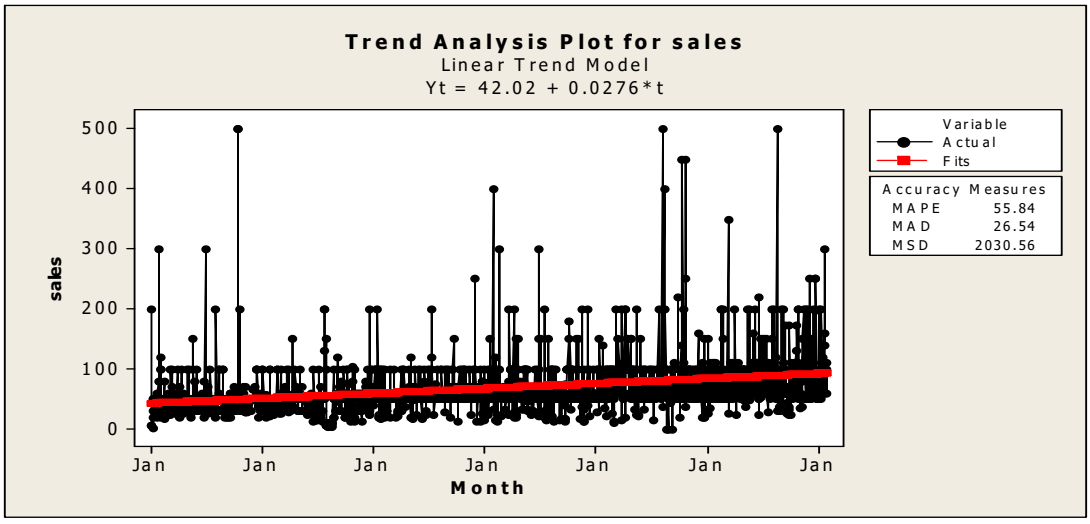


Figure 3: shows linear trend plot for sales

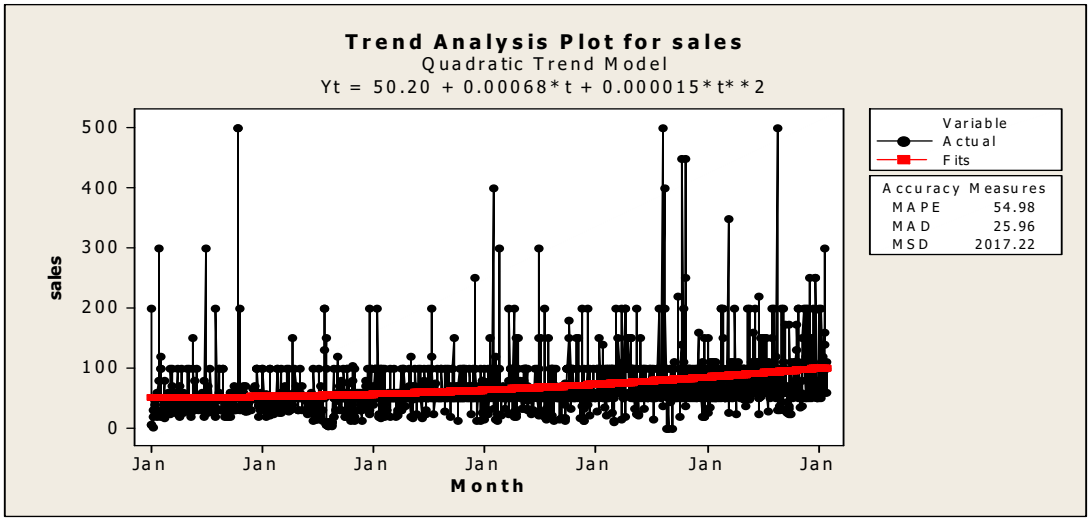


Figure 4: shows quadratic trend plot for sales

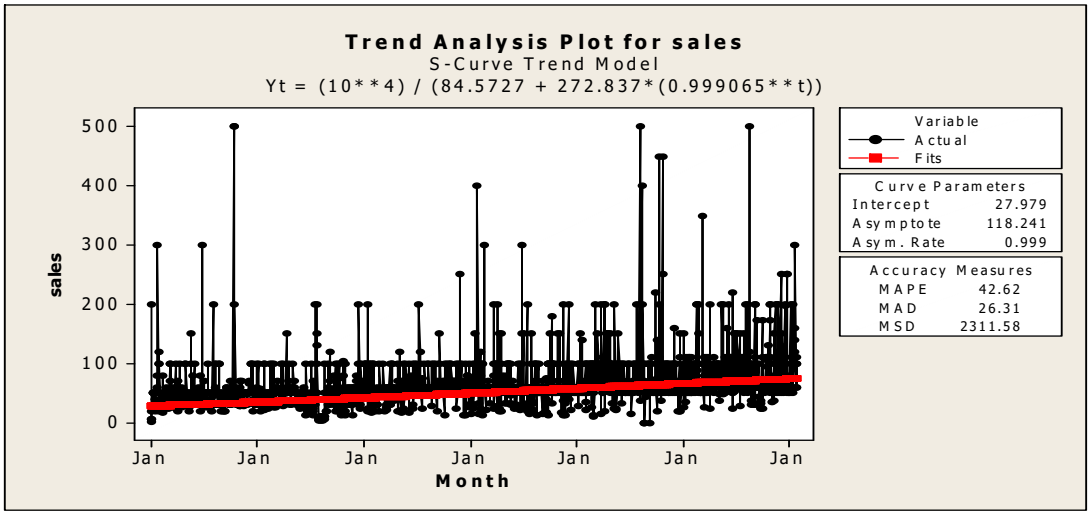


Figure 5: linear trend model

Figures 3, 4, and5 show the linear, quadratic,and curve linear models respectively.For the various figures the rounded dotted lines denote actuals values of sales of the insurance companies'products and fitted lines are based on the various models.

Table 6: Measures of Accuracy

Trend	MAPE	MAD	MSD
Linear	55.84	26.54	2030.56
Quadratic	**54.98**	**25.96**	**2017.22**
Curve linear	42.62	26.31	2311.58

It can be observed from table 6 that the best model to describe the trend in sales of the insurance products over the period of 2013 to2018 is quadratic trend, since it has the minimum values of MAPE,MAD and MSD**.** This

implies that quadratic trend is the most appropriate model that best describe the sales of the insurance products within the municipality.

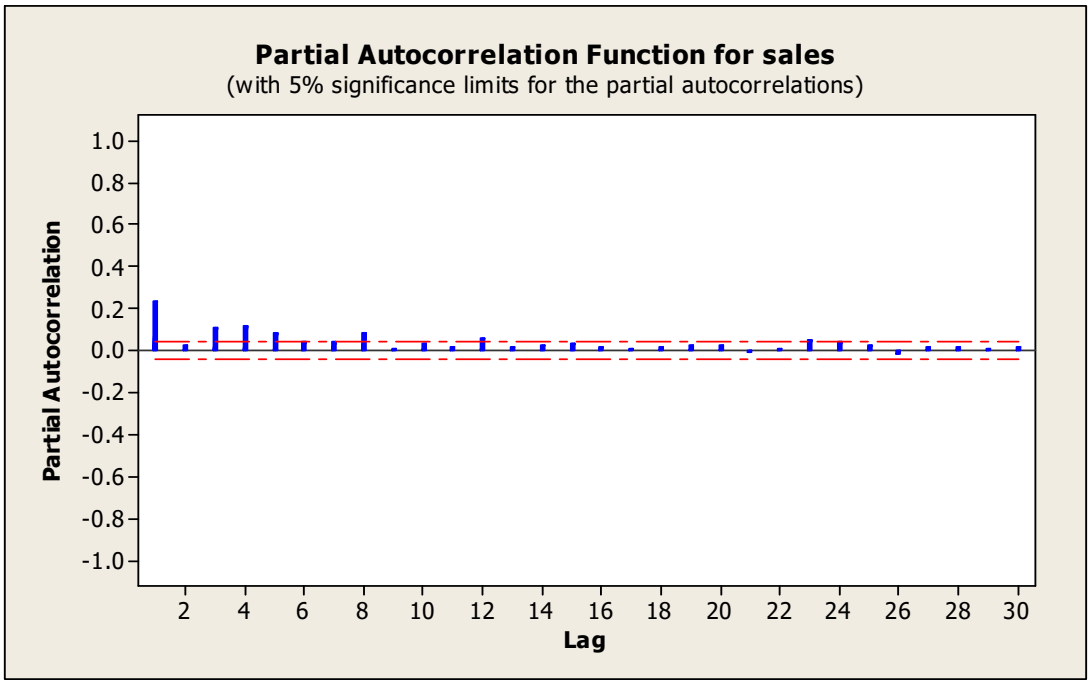


Figure 6: shows ACF plot of sales of insurance products

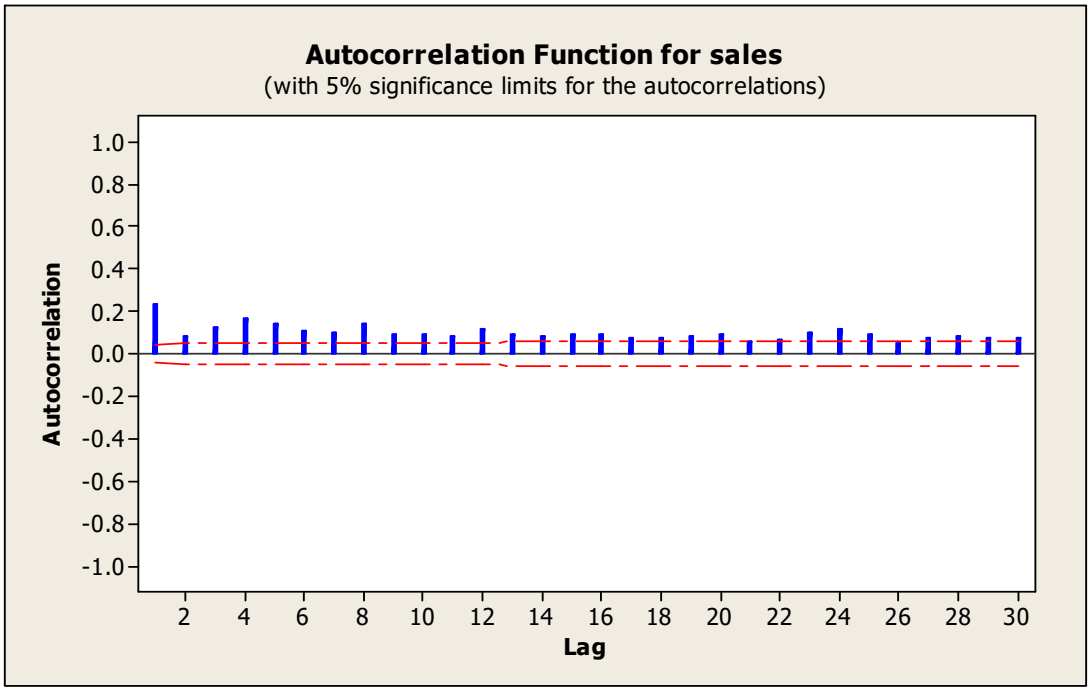


Figure 7: shows PACF plot sales of insurance product

A follow-up analysis was conducted onPartial Autocorrelation Function (PACF) and Autocorrelation Function (ACF) plots. The plot of ACF and PACF for the series appears not be stationary at 95% confidence interval. The

ACF divesup and down slowly with significant spikes at lags 1, 2, 3, 4,5 and 6 of the PACF as illustrated in Figures 6 and 7

Table 7: Model Identification

Model	AIC	BIC	HQ
ARIMA(0,2,1)	20010.61	20027.13	20016.71
ARIMA(0,2,2)	19072.55	19094.58	19080.68
ARIMA(0,2,3)	**19028.59**	**19056.13**	**19038.75**
ARIMA(1,2,1)	19700.35	19722.38	19708.47
ARIMA(1,2,2)	19031.89	19059.43	19042.05
ARIMA(1,2,3)	19029.62	19062.66	19041.81

In order to identify the model suitable to describe the sales of the insurance products the researchers made use of the Akaike Information Criteria (AIC), Bayesian information criterion (BIC) and Hannan-Quinn (HQ). This selection criterion would be based on the minimum values of the AIC, BIC and HQ. Thus, by careful examination of all the calculated models in Table 9the ARIMA (0, 2, 3) model has the minimum values and hence the appropriate model for estimating.

Table 8: Parameter estimation of the model

Model	coefficient	std. error	z	p-value
constant	**2.88564e-05**	**1.09064e-05**	**2.646**	**0.0081 *** **
Ma_1	**1.83231**	**1.53652e-05**	**1.193e+05**	**0.0000 *** **
Ma_2	**0.664634**	**1.17592e-05**	**5.652e+04**	**0.0000 *** **
Ma_3	**0.167681**	**7.81911e-06**	**2.145e+04**	**0.0000*** **

Table 8 shows theestimations of the parameters of the ARIMA (0, 2, 3) model. AR (0), MA(1), MA(2) and MA(3) are significant at 5% levels with coefficients and p-values of 0.000and respectively less than 0.05 indicating the significance of the parameters.

Model diagnosis

To determine appropriate model there is the need to perform the following diagnosis.

Residual plot

The patterns of the residuals over time around the zero mean as seen in figure 8 indicate that the residuals are random and independent of each other, thus, indicating that the model is fit.

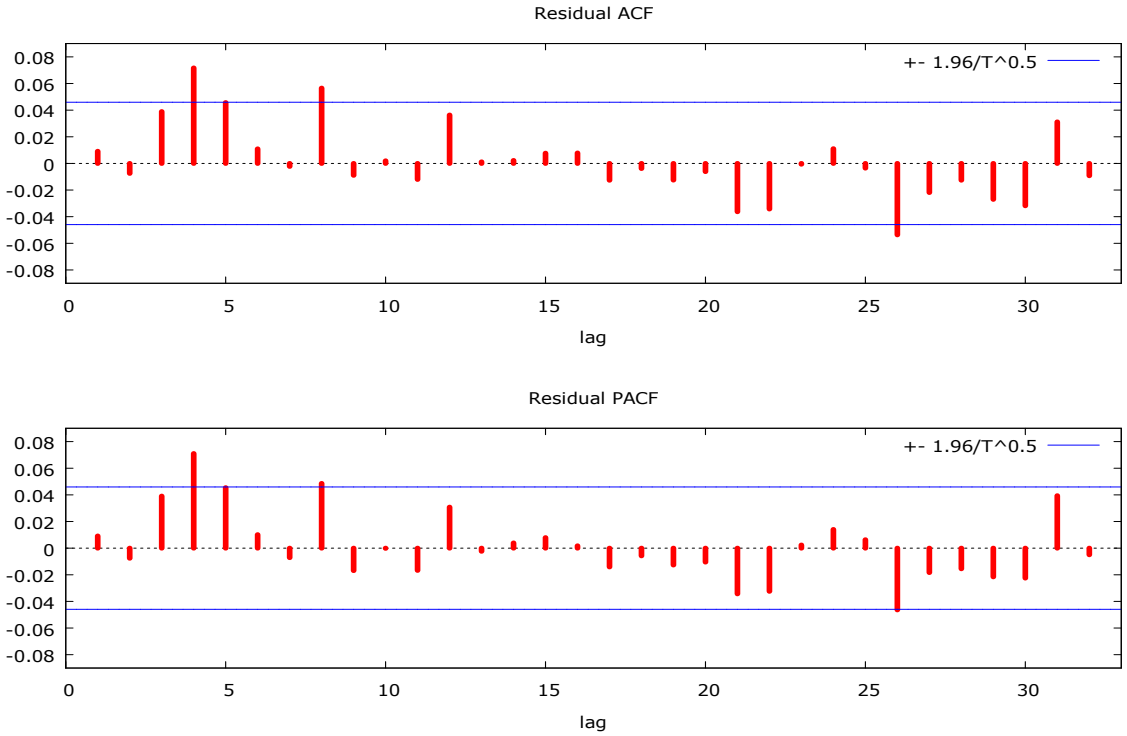
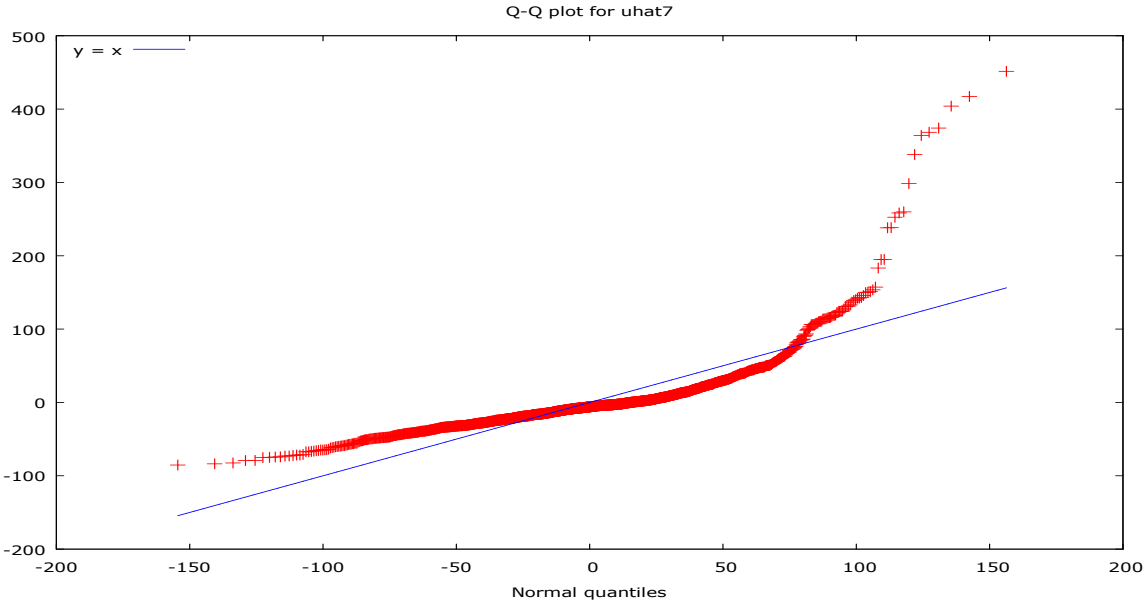


Figure 8: residual plot of ACF and PACF

Figure 8 shows all autocorrelation spikes within the 95% confidence interval. This means that there is no serial correlation between residuals indicating that they are accurate and the model is adequate.

Normal Q-Q plot of the residual



The Q-Q plot in Figure 9 shows all points along the normality line except for one outlier, hence the model is deemed fit.

Normality graph

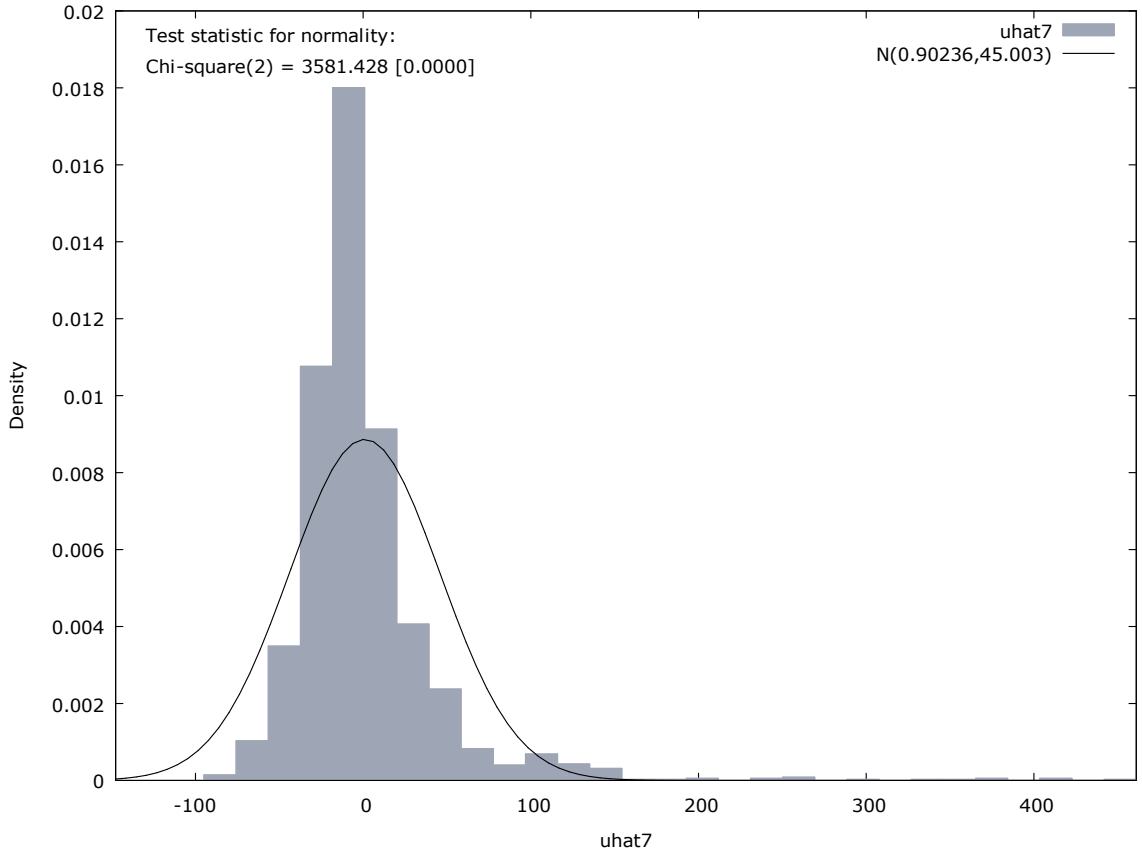


Figure 10: Normality graph

Lung-box statistic

Table 10: Lung-box statistic

Model	Statistic	df	p-value
ARIMA(0,2,3)	**23.567**	**18**	**0.576**

Table 10 indicates the lung-box statistic is 23.567 with p-value of 0.576 which indicate that the model is adequate and can be use forforecasting.

FORECAST

Point Forecast	prediction	std. error	Lo 80	Hi 80	Lo 95	Hi 95
2019/10/31	101.68	44.397	14.66	-	188.69	
2019/11/01	100.61	45.016	12.38	-	188.84	
2019/11/02	100.62	45.016	12.39	-	188.85	
2019/11/03	100.63	45.016	12.40	-	188.86	
2019/11/04	100.64	45.016	12.41	-	188.87	

2019/11/05	100.65	45.016	12.42 - 188.88
2019/11/07	100.66	45.016	12.43 - 188.90
2019/11/08	100.68	45.016	12.45 - 188.91
2019/11/09	100.69	45.016	12.46 - 188.92
2019/11/10	100.70	45.016	12.47 - 188.93
2019/11/11	100.71	45.016	12.48 - 188.94
2019/11/12	100.72	45.016	12.49 - 188.95
2019/11/14	100.73	45.016	12.50 - 188.96
2019/11/15	100.74	45.016	12.51 - 188.97
2019/11/16	100.75	45.016	12.52 - 188.99
2019/11/17	100.77	45.016	12.54 - 189.00
2019/11/18	100.78	45.016	12.55 - 189.01
2019/11/19	100.79	45.016	12.56 - 189.02
2019/11/21	100.80	45.016	12.57 - 189.03
2019/11/22	100.81	45.016	12.58 - 189.04
2019/11/23	100.82	45.016	12.59 - 189.05
2019/11/24	100.84	45.016	12.60 - 189.07
2019/11/25	100.85	45.016	12.62 - 189.08
2019/11/26	100.86	45.016	12.63 - 189.09
2019/11/28	100.87	45.016	12.64 - 189.10
1955/11/29	100.88	45.016	12.65 - 189.11
2019/11/30	100.89	45.016	12.66 - 189.12
2019/12/01	100.91	45.016	12.67 - 189.14
2019/12/02	100.92	45.016	12.69 - 189.15
2019/12/03	100.93	45.016	12.70 - 189.16
2019/12/05	100.94	45.016	12.71 - 189.17
2019/12/06	100.95	45.016	12.72 - 189.18
2019/12/07	100.96	45.016	12.73 - 189.20
2019/12/08	100.98	45.016	12.75 - 189.21
2019/12/09	100.99	45.016	12.76 - 189.22
2019/12/10	101.00	45.016	12.77 - 189.23

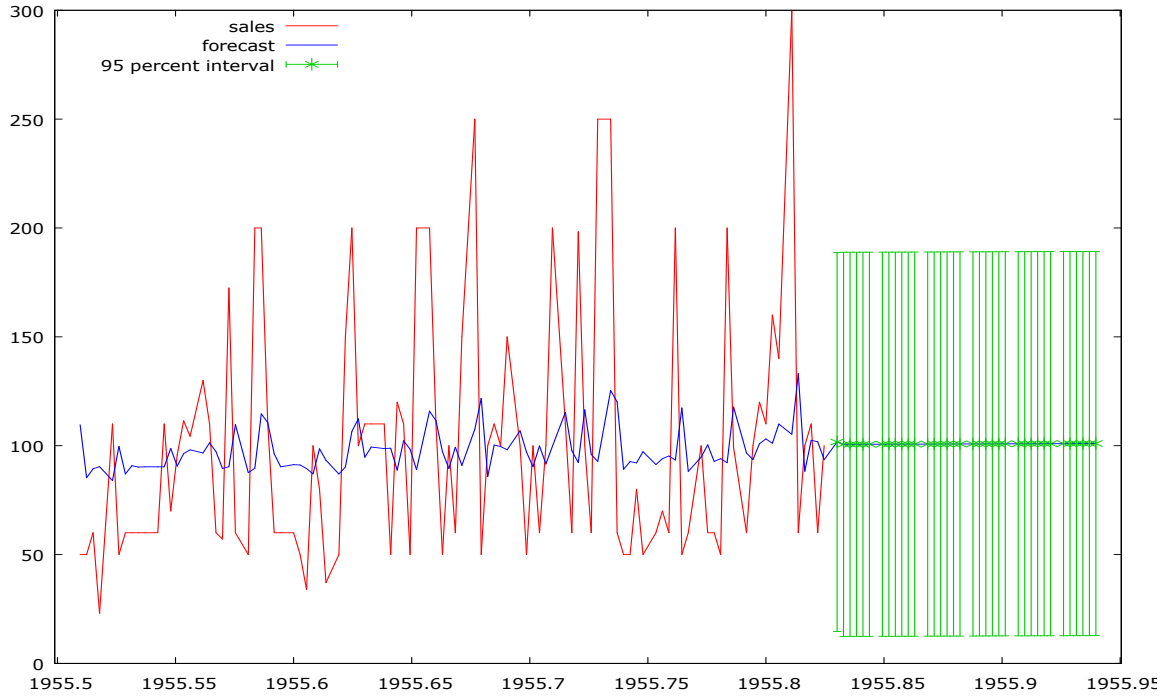


Figure 11: Forecast graph

Figure 11 shows that the sales of the insurance products are likely to stagnate.

Summary of the findings

The findings revealed that that sales product is skewed to the right, indicating that most of the insurance product above the average amount of approximately 67.16**.** These together with the high variability amongst the sales products obtained indicate that sales of the insurance products for period saw gradual improvement over the study period. The plots from the trends also showed vigorous fluctuations in the sales product indicating there is no strong marketing strategy for marketing the insurance products within the municipality hence the sales were unstableover the study period. Finding also revealed that sales of the insurance companies be described by quadratic trend and ARIMA (0, 2, 3). The findings further revealed that, there were significant performances of sales of insurance product between years and among various insurance products within the municipality.

Conclusion

The research paper concluded that sales of the insurance products are likely to stagnate in the future as indicated on the forecasted curve. The insurance companies needstrategic marketing techniques to help market their products in order to increase sales of their products. In addition, the companies should build trust and confidence in the customers they serve.

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