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Time series analysis of egg production in case of Ethio-chicken in the Gubre Sub -city

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ACRONYMS AND ABBREVIATIONS

ACF = Autocorrelation function

ADF= Augmented Dickey Fuller

AIC= Akaike Information Criterion.

AR = Autoregressive.

ARIMA = Autoregressive integrated moving average.

ARMA = Autoregressive moving average

BIC= Bayesian Information Criterion

MA = Moving Average.

MAD = Mean Absolute Deviation

MAPE = Mean Absolute Percentage error

MSD = Mean Square Deviation

PACC= Partial Autocorrelation Coefficients.

PACF= Partial Autocorrelation Function

PP= Phillips-Perron

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ABSTRACT

This study is attempted to investigate the trends of actual yield of egg production at ethio chicken in gubre subcity poultry farm. A total of 58 weeks of egg production was included in this study. The study used both descriptive and inferential statistics to analyze the data that were collected from the poultry farm of the sector. The results of descriptive statistics revealed that the mean, minimum and maximum egg production in the study area were 220749, 17 and 296592 respectively. The study employed inferential statistics for the purpose of estimating the trend, stationary and diagnostic test for testing the presence of autocorrelation. The data become stationary at first order differencing. The finding showed that the trend of egg yield of the hens' species is decreasing. And, ARIMA (1, 1, 1) is an appropriate adequate model for the data. The study leads to forecasting the egg yield of 07/31/2021 to 11/07/2021 weeks.

Key words: - Egg production, Trend analysis, ARIMA model and Gubre sub-city.

CHAPTER ONE

INTRODUCTION

1.1. Background of the study

In Ethiopia, the agricultural sector is a cornerstone of the economic and social life of the people (Tadelle 2003). At national level in Ethiopia, 99% of the total, 56.5% million, estimated chickens are contributed by village poultry production while only 1% is form intensive exotic breed maintained under intensive management system (Taddelle et al., 2003). Livestock production covers 40% of agricultural output in Ethiopia, playing an important role in national economy as it contributes 18% of the total GDP (FAO, 2004). A Central Statistics Agency (CSA) (2005) report revealed that 97.8% of the total poultry population Comprises indigenous birds, while 2.2% are exotic breeds. The poultry sector in Ethiopia can be characterized into three major production systems based on some selected parameter such as breed, flock size, housing , feed, health, technology, and bio-security. These are large commercial, small scale commercial and village or backyard poultry production system. These production systems have their own specific chicken breeds, inputs and production properties. Each can sustainably coexist and contribute to solve the socio-economic problems of different target societies (Tadelle et al., 2003).

The backyard (traditional) poultry production system is characterized by low input, low output and periodic destruction of large proportion of the flock due to disease outbreaks (Tadelle et al., 2003b). With the aim of improving poultry productivity, different breeds of exotic chickens (Rhode Island Red, Australord, New Hampshire and White Leghorns) were imported to Ethiopia since the 1950s. Since then higher learning institutions, research organizations, the Ministry of Agriculture and Non-Governmental Organizations (NGO's) have disseminated many exotic breeds of chickens to rural farmers and urban-based small-scale poultry producers (Solomon, 2008).

The diverse agro ecology and agronomic practice prevailing in the country together with the huge population of livestock in general and poultry in particular, could be a promising attribute to boost up the sector and increase its contribution to the total agricultural output as well as to improve the living standards of the poor livestock keepers.

Poultry production, as one segment of livestock production, has a peculiar privilege to contribute to the sector. This is mainly due to their small size and fast reproduction compared to most other livestock and its well fitness with the concept of small-scale agricultural development. Moreover, it goes eco friendly and does not compete for scarce land resources. Poultry farming is widely practiced in Africa almost every farmstead keeps some poultry mainly for consumption and cash sales. Religions and cultural considerations are also amongst the reasons for keeping chickens by resource poor farmers in Africa. (Dwinger et al., 2003).

Although, Gubre subcity which is found in Gurage Zone, southern Ethiopia has poultry farming practiced in the area, there is no well documented and no research conducted so for in the area in determining the poultry production practices by assessing its potential and constraints. Therefore, this research aimed to assess the existing potential constricts of poultry production in the study area.

1.2. Statement of the problem

Modern poultry production stetted in Ethiopia some year ago mainly in colleges and research stations. The activities of these institutions mainly production on the introduction of exotic breeds to the country and distribution of these breeds to the farmers including management, feeding , housing and health care practices (Tadelle and olge,2011 **).**

Poultry products especially, egg production is an integral part of Gubre breeding farming system. Even though the area has potential for egg and poultry products, little is known about the applying poultry production system and techniques, building appropriate model of egg production, and opportunities associated with paltering in the area. Another problem of the eggs production would be decrease or increase time to time due to weather condition and also the decrement of egg production is directly affecting the income of company. Therefore, this study is designed to give directions these problems by applying appropriate method of egg production and give hints for the sector weather the production will decrease or increase in the next year.

As the end of this study, the following questions have been expected to be answered.

- What is the forecast of egg production pattern at Ethio-chiken in Gubre subcity?
- Which type of times series model is appropriate to fit data?

1.3. Objective of the study

1.3.1 General Objective

The general objective of this study is to fit time series model and forecast of eggs production at Ethio-chicken in the Gubre breeding farm.

1.3.2 Specific objectives

The specific objectives of this study are the following

- To fit and select appropriate model for weekly egg production at Ethio-chiken in Gubre subcity.
- To forecast the egg production pattern at Ethio-chiken in Gubre subcity.

1.4. Significance of the study

The outcome of this study is expected to contribute the methodology of measuring trend of eggs yield and as option as customers requirements. By predicting future amount of egg production we can given to company the direction of need their customers and also increase profit from the production.

CHAPTER TWO

LITERATURE REVIEW

2.1. Characterization of smallholder poultry production systems.

Generally, there are four poultry production systems in developing countries and in Africa. These include the free-range system or traditional village system; the backyard or subsistence system; the semi intensive system and the Small-scale intensive system (Bessei, 1987; Sonaiya, 1990a; Kitalyi, 1998; Branckaert and Gueye, 2000 and Gueye, 2000a). The most common production system found in Africa are the free-range and backyard production systems (Sonaiya, 1990a; Gueye, 2003) and approximately 80% of chicken populations in Africa are reared in these systems (Gueye, 1998). The chicken in this system are a function of natural selection. As a result the performance of chickens under rural conditions remain generally poor as evidenced by highly pronounced broodiness, slow growth rates, small body size and low production of meat and eggs (Kitalyi, 1998; Sonaiya, 2000). Poultry production systems in Ethiopia show a clear distinction between traditional low input systems and modern production system using relatively advanced technology. There is also a third emerging small-scale intensive system as an urban and pier urban small-scale commercial system (Alemu and Tadelle, 1997).

2.2. Importance of the small holder chicken production systems

Chicken production is an important agricultural activity of almost all rural communities in Africa, which makes the best use of locally available resource. Though neglected in the development themes for a long time, now a day's many researchers and development agents are becoming in to consensuses that the small holder chicken production play a major role in poverty alleviation and food security at household level. It provides off-farm employment and income generating opportunity and source of gifts and religious sacrifices (Wethli, 1995; Sonya, 1990a; Gueye, 2003; Tadelle and Ogle, 2001; Sonaiya, 2000). Scavenging chicken also serve in waste disposal system by converting left over of grains and human foods and insects in to valuable protein foods-egg and meat (Doviet, 2005).

The smallholder poultry production considered as an income-yielding activity that fits well with the concept of small-scale agricultural development. Moreover, land, which is a critical production resource in rural Ethiopia, is not a limiting factor in the smallholder chicken production systems. Village chicken products are often the only source of animal protein for resource-poor households.

2.3. Socio economic aspects of poultry production

2.3.1 Social and economic scenario.

Nearly all rural families keep a small flock of poultry and rearing of poultry has practiced for many generations for different social and cultural reasons (Gueye, 2003). However, the most common purpose for keeping chickens and eggs were primarily as source of income and for hatching, respectively. According to the study conducted in the Central Highlands of Ethiopia by Tadelle et al. (2003), about 50%, 27% and 23% of the egg produced are used for hatching, sale and home consumption, respectively. In another study conducted by Aberra (2007) in southern some parts of Ethiopia, about 71.4% of chickens raised by the rural community were used for egg production while the rest 28.6% were used for meat production purposes.

There are fewer religious or social taboos associated with poultry production than there are with pigs and cattle. Poultry keeping rather has a symbolic importance within the context of social cultural and religious function. For most of these social and cultural functions or sacrifices, a specific sex and plumage color of poultry are prescribed (Gueye, 2003). For instance, Tadelle and Ogle (2003) reported white and red cock sacrificed for the purposes of good harvest wishes and red and black spotted cock sacrificed for the purpose of Ethiopian New Year. In general, rural poultry plays a significant role in cultural and social life of rural people in the following ways: as gifts for relatives and for religious ceremonies, cock as alarm clock, to cure a sick person, staring capital to youth and for special guests' invitation. For instance, farmers in rural area invite special guests to partake of the popular dish "doro wat", which contains both chicken meat and eggs and (Sonya, 1990a; Sonaiya, 2000; Tadelle and Ogle, 2001).

2.3.2. Decision making on and ownership of chickens

The pattern of ownership differs to some extent according to sex and age of the owner; hence, the ownership of chickens shared among all gender categories. No data are available at national level. However, some studies showed that women have a more active interest in poultry ownership than men do. According to the survey made in Welaita (Hoyle, 1992), senior men and senior women have the highest flock ownership accounting to 30% and 47%, respectively when compared to the other gender groups boys and girls. Usually ownership affects decision-making and management of the chickens. The management of rural chicken in Africa is a family affair with construction of chicken house and major decisions making issues such as sale of chicken and eggs and consumption of poultry products under the control of the men. Whereas looking after chicken, controlling and utilizing the earnings from the sale of eggs and chicken belongs to women (Gueye, 2003). Kitalyi (1998) showed that in Gambia, there was gender plurality in decision-making in village chickens production. The same source indicated that in the United Republic of Tanzania men dominated in both selling and buying chickens in village markets.

2.4. Egg processing

Improved technology and the development of mechanical equipment were responsible for small-scale egg processing lines to become large commercial operations(American Egg Board,2000).egg products for commercial usage include liquid, frozen and dried whole egg, albumen and yolk. Various blends of whole egg and yolk are also included. Steps to be followed during whole egg processing are; breaking, homogenization, pasteurization, freezing and drying.

2.5 literature reviews related with the study variable

Literature reviews study was attempted to investigate the trends of actual yield of egg production in Haramaya University poultry farm for research on egg production at Haramaya University (desta, 2015). The quantitative data sets were analyzed using appropriate statistical analysis procedures. The mean annual egg production of hen in Haramaya University was 31.42 and ranged from 10.24 - 47.66 eggs and also the model is selected by using AIC. Since, ARIMA (0,1,1) for egg production have lower values of AIC it is found to be the most appropriate model to fit the data of egg production.

CHAPTER THREE

DATA AND METHODOLOGY

3.1. Study area

The study is conducted at Gubre subcity, found near to Wolkite University. Gubre subcity is found SNNPR, Gurage Zone, around Wolkite city and it is located around 173km south west of Addis Ababa along the Jimma Road in the Southern Region of Ethiopia.

3.2. Source of data

For this study, the data was obtained from Ethio-chicken in the Gubre subcity poultry farm sector from 06/20/2020-07/24/2021 weeks. The data provide information on weekly and yearly egg recorded.

3.3. Study Variables

3.3.1. Dependent variables

Dependent variables are known as response variables which influenced by another variables known as explanatory variables or determinants. In this study this variables is:-

- Average of Weekly the egg production

3.3.2. Independent variables

Independent variables are also variables known as explanatory variables or determinants those have influence to the other variables known as dependent or response variables. In this study the independent variables is the time measure at which egg production.

3.4. Data Analysis in Time Series

3.4.1 Test of stationarity

I) Graphic Inspection (correlogram test)

We can identify stationary by using the graph of the correlogram of the series. The correlogram of stationary series drop off as k, the number of lags becomes large.

II) Augmented Dickey Fuller ADF) Test

By including lags of the order *p* the ADF formulation allows for higher-order autoregressive processes. This means that the lag length *p* has to be determined when applying the test. One possible approach is to test down from high orders and examine the t-values on coefficients. An alternative approach is to examine information criteria such as the Akaike information criterion and Bayesian information criterion.

The testing procedure for the ADF test is applied to the model

Where is a constant, the coefficient on a time trend and the lag order of the autoregressive process Imposing the constraints and corresponds to modeling a random walk and using the constraint corresponds to modeling a random walk with a drift. The unit root test is then carried out as:

Ho: non stationary

Ha: stationary

Test statistic is given by

is computed and compared to the critical value for the Dickey–Fuller Test. If the test statistic is less than the critical value, then the null hypothesis of is rejected and no unit root is presented.

III) The Phillips-Perron (PP) Test

It is used in time series analysis to test the null hypothesis that a time series is integrated of order 1.It builds on the Dickey–Fuller test of the null hypothesis $\delta = 0$ in $\Delta\ y_t = \delta y_{t-1} + u_t$, where Δ is the first difference operator. Like the augmented Dickey–Fuller test, the Phillips–Perron test addresses the issue that the process generating data for y_t might have a higher order of autocorrelation than is admitted in the test equation - making y_{t-1} endogenous and thus invalidating the Dickey–Fuller test zero. The testing procedure for the PP test is applied to the model .

The PP test is based on the statistic:

$=t_\alpha$ (

Where â is the estimate of α, tα is the t -ratio of α, se(â) is coefficient standard error and s is the standard error of the test regression. In addition, γo is a consistent estimate of the error variance, The remaining term, , is an estimator of the residual spectrum at frequency zero.

3.4.2. Examining stationary of time series data

1) **Time series plot:-**
   - If a time series is plotted and if there is no evidence of a change in a mean over time then we say the series is stationary on the mean.
   - If the plotted series shows no obvious change in the variance time then we say the series is constant variance.
2) **ACF (Autocorrelation function**)

The autocorrelation of stationary data drops to zero relatively quickly, while for non-stationary data they are significantly different from zero for several and PACF will have a long spike close to 1 at lag 1.

3) **Transformations**

Transformation: is the process of changing a non stationary time series into a stationary time series. It is often useful to transform time series for analysis or forecasting. Many time series analysis and forecasting methods are most appropriate for time series with an unrestricted range, a linear trend, and a constant variance. Series that do not conform to these assumptions can often be transformed to series for which the methods are appropriate.

3.5. Approaches to Time Series Analysis

3.5.1. Estimation of Trend Component

Trend analysis fits the general model to time series data and to estimate the constant mean model and also provide forecasts among the linear or non linear trend model.

Trend is general tendency to increase or decrease during a long period. There are several methods to estimate trend. From these methods, graphical method, semi-average method, moving average method, and least square method are used for determine trend analysis of egg production.

3.6. Time series model

Box-Jenkins methodology: The Box-Jenkins methodology refers to a set of procedure for indentifying and estimating time series models with the class of Autoregressive process (AR), Moving Average (MA), ARMA, and ARIMA models.

I. White Noise (pure random) process

A time series is called white noise if $\{Y_t\}$ is a sequence of independently and identically distributed random variables with finite mean and variance. The means $Y_t = \mu t$ describes a pure random process with:

and in addition t is normal distributed. This assumption is expressed by writing

Where. Stands for independently and identically distributed random variable.

II. Autoregressive process of order p, AR (p):

ACF/PACF Patterns for **AR** models tend to fit smooth time series well, while MA models tend to fit irregular series well. It is given by the following general formula.

The Stationarity or non-stationarity depends on the coefficients that is if

Absolute value of alpha lie inside the unit circle, it is stationary.

III . Moving Average Model of Order q, MA (q).

It is given by the following formula:

MA (q) can be represents as AR (∞), thus we expect the opposite patterns for MA processes. The PACF will dampen exponentially. The ACF will be used to identify the order of the MA process.

IV. Autoregressive Moving Average, ARMA (p, q).

It is given by the following the general equation as follows:

With ε_t white noise

It is the combination of autoregressive and Moving Average. If p=0,it is reduced to (MA) and if q=0, it reduced to MA(q), process. We may see dampening in both the ACF and PACF, which would indicate some combination of AR and MA processes. Once we have examined the ACF & PACF, we can move to the estimation stage.

V. Autoregressive integrated moving average ARIMA (p, d, q).

In practice most time series are non stationary. One procedure that is often used to convert a non stationary series to stationary is using successive difference. Formula of ARIMA

(1-B)

Where B is lag operator

3.7. Building ARIMA Models

a) Model selection and identification:

Identification and selection applied when the data confirmed stationary only. This step is the determination of the appropriate values of p, d, & q using the ACF, PACF, and unit root tests (p is the AR order, d is the integration order, q is the MA order). If the series is MA (q) process it cutoff the limits after certain lag k and if it is AR (p) and ARMA (p,q) sample auto correlation dies gradually as k increases. Tentative identification of models identified by using sample-Autocorrelation function (ACF), Partial autocorrelation (PACF), Akaike information criterion (AIC) and Bayesian information criterion (BIC) .

Autocorrelation Function (ACF): The ACF represents the degree of persistence over respective lags of a variable.

$\boldsymbol{\rho_k = \gamma_k / \gamma_0}$, were $\boldsymbol{\rho_k}$ - Autocorrelation function

$\boldsymbol{\gamma_k}$ - covariance of lag k

$\boldsymbol{\gamma_0}$ - variance

Partial Autocorrelation Function (PACF)

The lag k partial autocorrelation is the partial regression coefficient, θ_{kk} in the k^{th} order auto regression and given by;

By using ACF and PACF we can identify model as follow

	AR(p)	MA(q)	ARMA(p,q)
ACF	Tail off	Cut off after lag q	Tail off
PACF	Cut off after lag p	Tail off	Tail off

Table 3.1 model identification using ACF and PACF.

b) Parameter Estimation

It is the step in which estimation of parameters are required. There are three methods to estimate parameters. These are moment method, least square estimate and maximum likelihood estimate. If the model is AR (p) process we can estimate by using Yule walker equation. However, for both AR (p) and MA (q) process it is possible to estimate by sample autocorrelation function. The estimation-stage results will be used to check Parameter estimates, the appropriateness of coefficient estimates which includes the statistical significance of estimated coefficient and standard error and correlation matrix.

c) Diagnostic checking:

After fitting a provisional time series model, we can assess its adequacy in various ways. We check residuals of estimate of ARIMA model(s) to see if they are white noise; Autocorrelation

Function (ACF) pick best model with well behaved residuals. Once we have identified a tentative model the next step is to determine the adequacy of the models.

Adequate model:

- The errors are random.
- All parameter estimated are significantly different from zero.
- The model has the smallest root mean squared error

Analyzing the residuals

To determine whether the error are random or not we use the modified Ljung Box Pierce statistic.

I. Test hypothesis

Ho: $\rho_1=\rho_2=\ldots\ldots\ldots=\rho_k=0$ [model is correct]

H1: $\rho_i\neq0$ for at least one k=1, 2…….k [model is not correct]

II. Level of significance (α)

III. Test statistic; [Modified Box Piece statistic]

IV. Decision rule: if , then the null hypothesis will be rejected, that means the model is not correct. If null hypothesis will be fail to reject, that means the model is correct.

d) Forecasting: The last step of the ARIMA modeling process is forecasting. In forecasting, the goal is to predict future values of a time series variable, based on the data collected to the present, . Throughout this section, we will assume is stationary and the model parameters are known.

3.8. Model selection criterion

- **Akaike Information Criterion (AIC)**

Given a set of model for the data, the preferred model is the one with the minimum AIC and BIC value. Hence **AIC** not only rewards goodness of fit, but also includes a penalty that is an increasing function of the number of estimated parameters.

This penalty discourages over fitting (increasing the number of free parameters in the model improves the goodness of the fit, regardless of the number of free parameters in the data-generating process). It is given by

$$AIC = 2k - 2\ln(L)$$

Where is the number of parameters in the statistical model and is the maximized value of the likelihood function for the estimated model. The AIC penalizes the number of parameters less strongly than does the Bayesian information criterion (BIC).

- **BIC (Bayesian Information Criterion)**

The BIC is an asymptotic result derived under the assumptions that the data distribution is in the exponential family.

n = sample size

k = the number of free parameters to be estimated

L = the maximized value of the likelihood function for the estimated model.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Descriptive statistics for egg production data

This study is based on the weekly time series data observed from 06/20/2020 to 07/24/2021. The total number of observation which were collected from Ethio chicken in gubre subcity were 58 weeks of the egg production data and the summary of this weekly data (like mean, median, minimum, maximum and standard deviation) are given in table 4.1.

Table 4.1: Descriptive statistics for egg production

Variable	N	Mean	SE Mean	StDev	Minimum	Q1	Media n	Q3	Maximum
egg production	58	220749	10616	80849	17	190177	248240	283735	296592

Table 4.1 showed that the minimum and maximum production of egg production was 17 and 296592 respectively. The average Yield of egg production for 58 weeks is 220749.

4.2 Time series plot

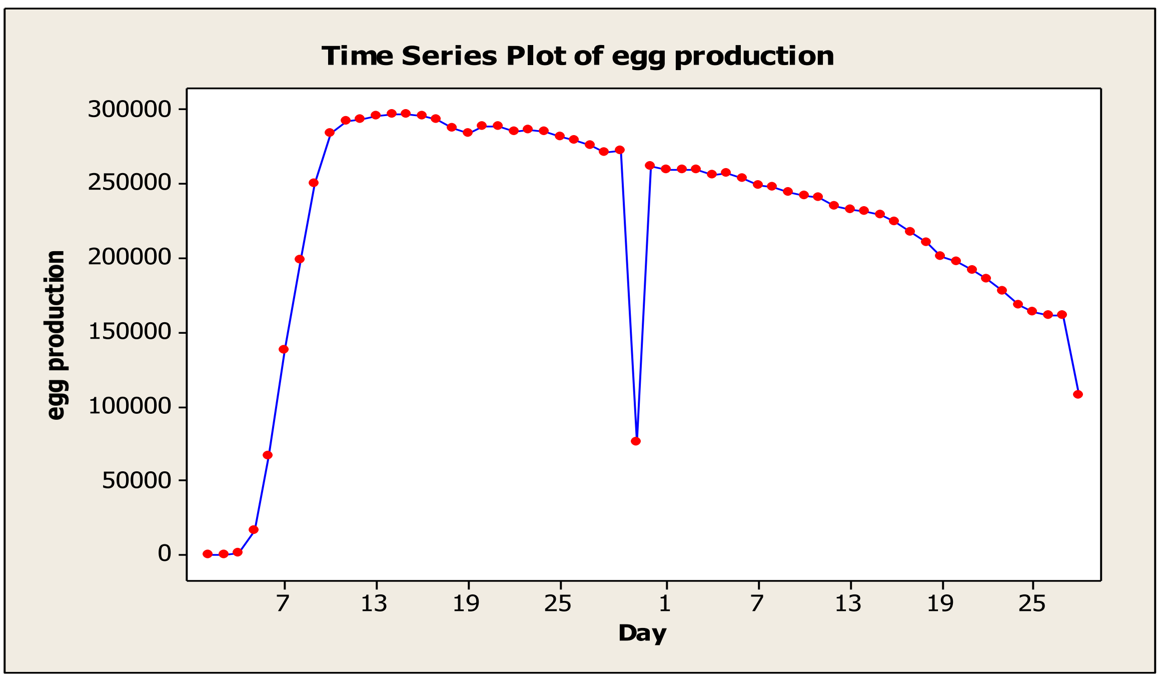


Fig 4.1 indicates that there is slightly series egg production (i.e. not stationary). Therefore, we have to change non-stationary time series in to stationary time series by taking successive difference of the number of egg production.

4.3 Stationary test for the data

Augmented Dickey-Fuller (AD) and Phillips–Perron test (pp) are used to check the stationary of the time series data (observation).

Table 4.2: Augmented Dickey-Fuller (ADF) and Phillips–Perron (pp) test for the stationary.

Variable	ADF	PP
Egg production	Dickey-Fuller = -0.359552	Dickey-Fuller t-(alpha) = -0.492068
	Lag order = 7	Truncation lag parameter = 3
P value	= 0.5508	= 0.4986

Hypotheses:

H_0: the data is not stationary (the data needs differencing)

H_1: the data is stationary (the data doesn't need differencing)

By using the ADF and PP test result the original data is not stationary, because p values of Phillips–Perron test (pp) were 0.4986 which is greater than 0.05 at the 95% level of significance so we do not reject the null hypothesis and concluded that the data is not stationary**.** This means that the mean and variance for the egg production data is not constant when the observation having no differencing (d=0).

4.4 Transformation of the original egg production data

The time series of first difference for egg production data does appear to be stationary after the first difference and interpreted as shown bellow.

Table 4.3: the result of the test of stationary of egg production data

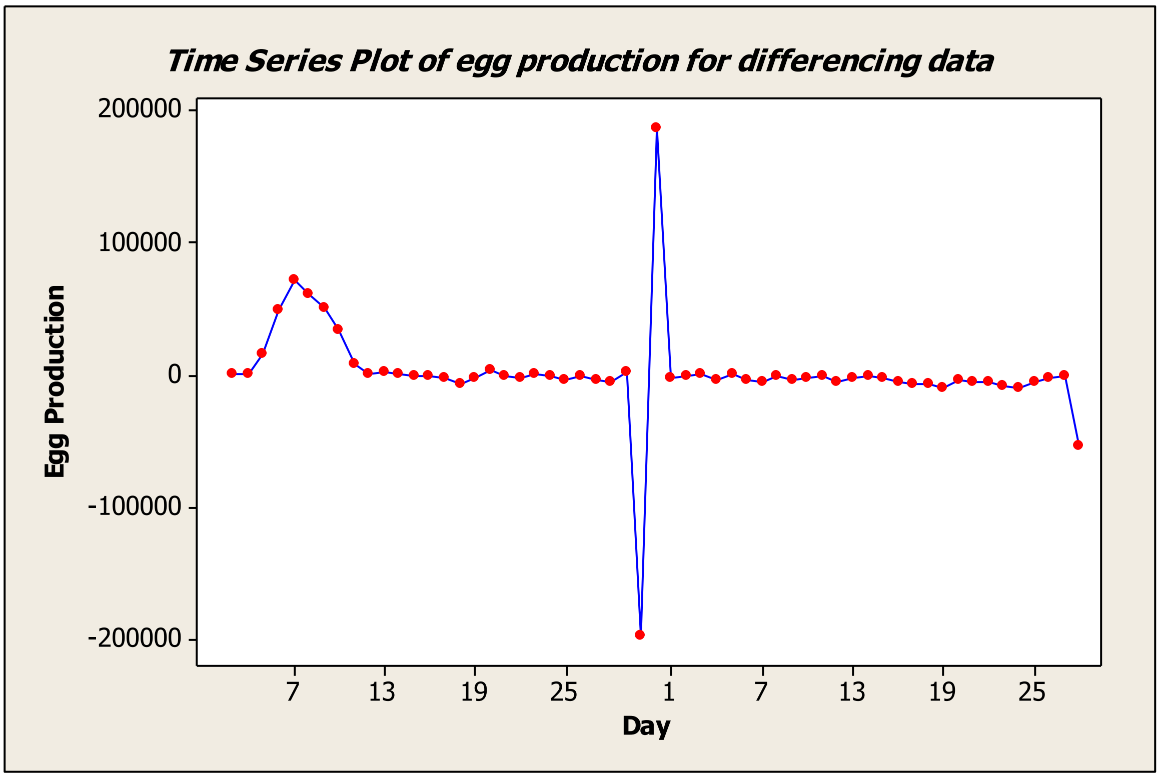
Variable	ADF	PP
Egg production	Dickey-Fuller = -5.231440	Dickey-Fuller t-(alpha) = -9.33885

	Lag order =7	Truncation lag parameter = 3
P value	0.0000	0.0000

From the table4.3 after first difference the p-values for both Augmented Dickey-Fuller Test and Phillips-Perron Unit Root Test are (0.0000) which were less than 0.05, and after the first difference the egg production data became stationary.

4.5: Time series plot of egg production for differencing data

Figure 4.6: time series plot off egg production for differencing



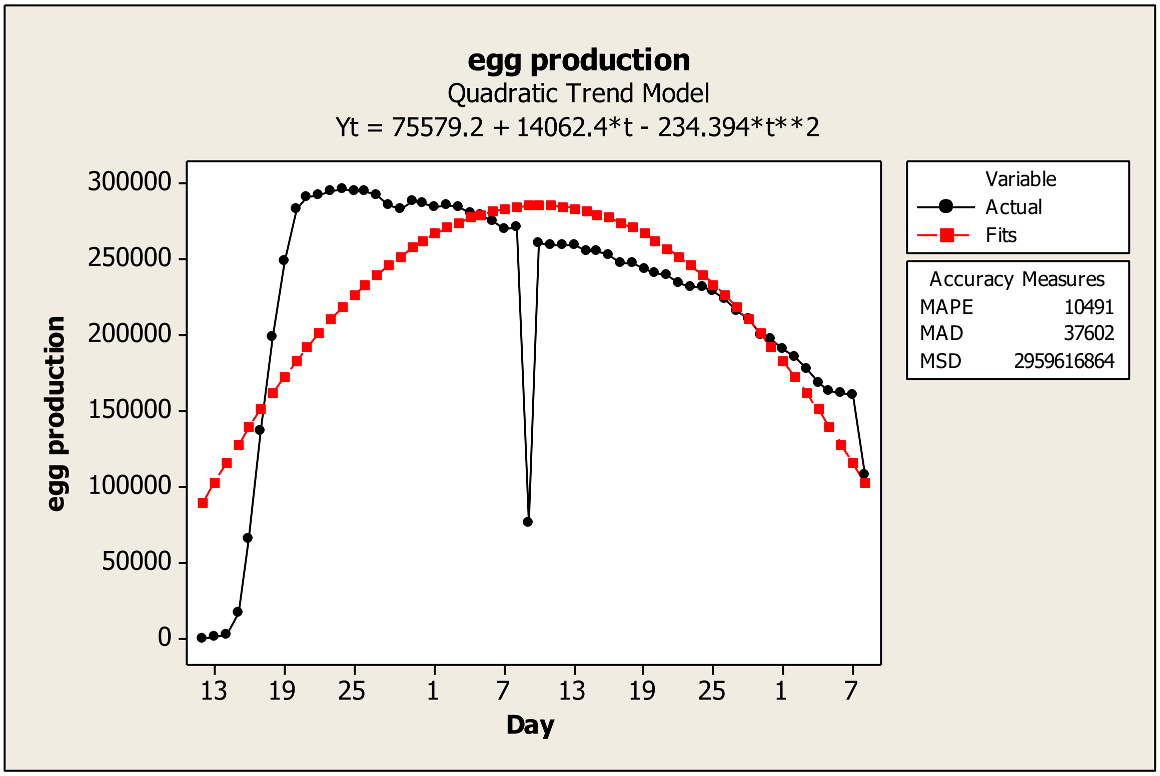
4.5 Trend Analysis

We compute the estimated trend value by using linear model method. To know the appropriate regression model; we have to compare MAD for linear and quadratic model. The data at hand seems to follow linear model because for linear model MAD=62064, but for quadratic model, MAD=37602.Therefore;

The estimated trend value is given by the equation

Fitted Trend Equation

Yt = 75579.2 + 14062.4*t - 234.394*t**2
Accuracy Measures
MAPE 10491
MAD 37602
MSD 2959616864
Trend Analysis Plot for egg production
Fig 4.3 Plot of the number of egg production for original



As we had seen from fig.4.3 the number of egg production is almost parabola decreasing from week to week of original data.

4.6 Model identification

4.6.1 Analysis of autocorrelation and partial autocorrelation for egg data

The first step in analyzing time series is to examine autocorrelation and partial autocorrelation**.** Autocorrelation and partial autocorrelation is the core of ARIMA model. The parameters of ARIMA consist of three components: p (Autoregressive parameter), d (number of difference), and q (moving average parameters).

From these analyses it is possible to identify the order of AR (p) process and MA (q) process. By plotting a correlogram and partial correlogram, in EViews the following table is obtained.

Table 4.3: Autocorrelation of egg production

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
**| . |	**| . |	1	-0.254	-0.254	3.8801	0.049
. |*. |	. |*. |	2	0.135	0.076	5.0009	0.082
. |*. |	. |*. |	3	0.074	0.135	5.3441	0.148
. | . |	. |*. |	4	0.032	0.077	5.4100	0.248
. | . |	. | . |	5	0.036	0.039	5.4948	0.359
. | . |	. | . |	6	-0.003	-0.010	5.4953	0.482
. | . |	. | . |	7	0.003	-0.022	5.4960	0.600
. | . |	. | . |	8	0.019	0.006	5.5219	0.701
. | . |	. | . |	9	-0.006	0.000	5.5246	0.786
. | . |	. | . |	10	-0.007	-0.011	5.5276	0.853
. | . |	. | . |	11	0.020	0.015	5.5574	0.901
. | . |	. | . |	12	0.001	0.013	5.5574	0.937
. | . |	. | . |	13	0.002	0.002	5.5576	0.961
. | . |	. | . |	14	0.004	0.000	5.5589	0.976
. | . |	. | . |	15	-0.005	-0.007	5.5605	0.986
. | . |	. | . |	16	-0.007	-0.014	5.5642	0.992
. | . |	. | . |	17	-0.009	-0.015	5.5711	0.996
. | . |	. | . |	18	-0.001	-0.004	5.5713	0.998
. | . |	. | . |	19	-0.026	-0.025	5.6334	0.999
. | . |	. | . |	20	-0.046	-0.060	5.8263	0.999
. | . |	.*| . |	21	-0.045	-0.069	6.0175	0.999
. | . |	. | . |	22	-0.028	-0.041	6.0942	1.000
. | . |	. | . |	23	-0.032	-0.023	6.1984	1.000
. | . |	. | . |	24	0.038	0.059	6.3445	1.000

By counting the lag of ACF there are 1 lag where the Autocorrelation function cuts off the -process so that the order of moving average is (q=1) and there are 1 lag where the Partial Autocorrelation function cuts of the process so the order autoregressive is(p=1) and also the correlogram and partial correlogram tail off to zero .So the possibility model to fit the data of egg production with differencing one (d=1) are ARIMA(1,1,1),ARIMA(1,1,0),ARIMA(0,1,1), ARIMA(0,1,0),ARIMA(0,1,1). By using AIC we obtain the appropriate model, as follow.

Table 4.4: AIC Model selection for egg production data

0rder of ARIMA	AIC	Log L
ARIMA(1,1,1)	24.142439	-697.174643
ARIMA(1,1,0)	24.143953	-696.130728
ARIMA(0,1,1)	24.912036	-717.449043
ARIMA(0,1,0)	25.490117	-737.213400

From the above results of AIC, ARIMA (1, 1, 1) is appropriate for egg production, since AIC is the lowest for this model than other.

4.6.2 Parameter estimation for egg production data

Once the order of ARIMA (p, d, q), model has been specified the next step is estimating parameters.

Final Estimates of Parameters

Table 4.5: final estimates parameters

Type	Coef	SE Coef	T	P
AR (1)	-0.3454	0.1355	-2.55	0.014
MA (1)	0.9003	0.0606	14.87	0.000

The AIC for ARIMA (1, 1, 1) is 24.142439

Thus for the egg production the fitted model was following

= -0.3454 -0.9003+

Since p-value for all lag is less than 0.05 and the AIC value for ARIMA (1, 1, 1) is less than the other, so this implies that the fitted model ARIMA (1, 1, 1) is an appropriate for the data.

4.6.3 Diagnostic checking

ACF of Residual for egg production

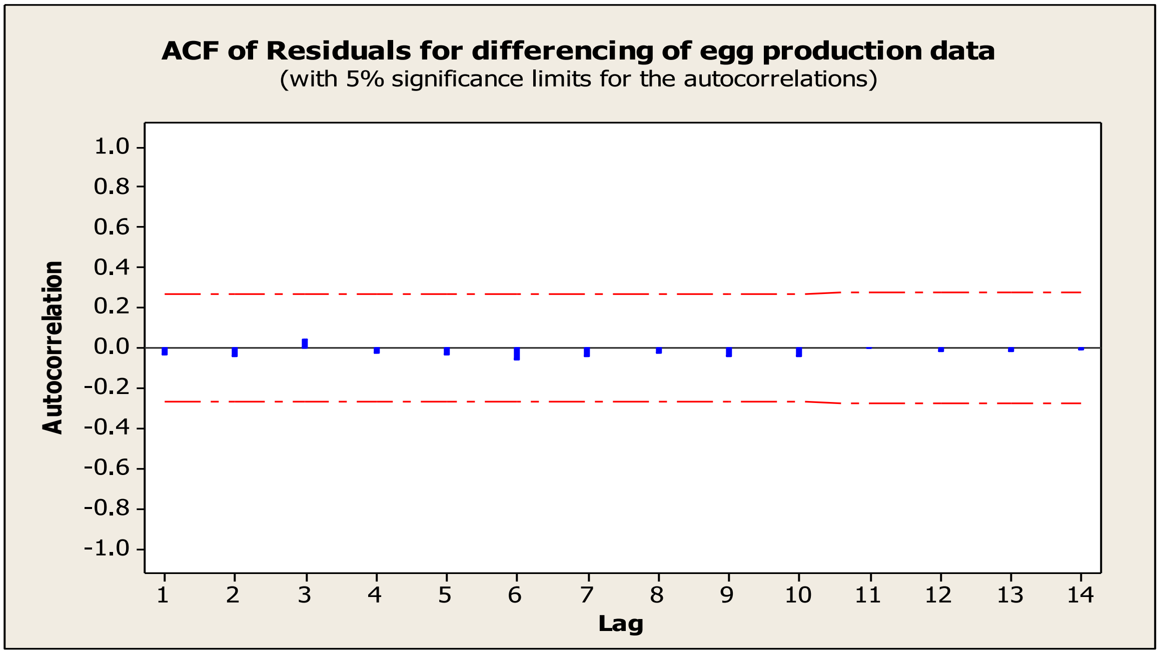


Fig 4.5 ACF of Residual for egg production The autocorrelation of residuals for the first 14 lags all sample AC for the 95% confidence bounds indicating that the residuals appears to be random. This leads the model ARIMA (1, 1, 1) is an appropriate adequate model for the given data.

4.6.5 Modified Box-Pierce (Ljung-Box) Chi-Square statistic test for the diagnostic checking

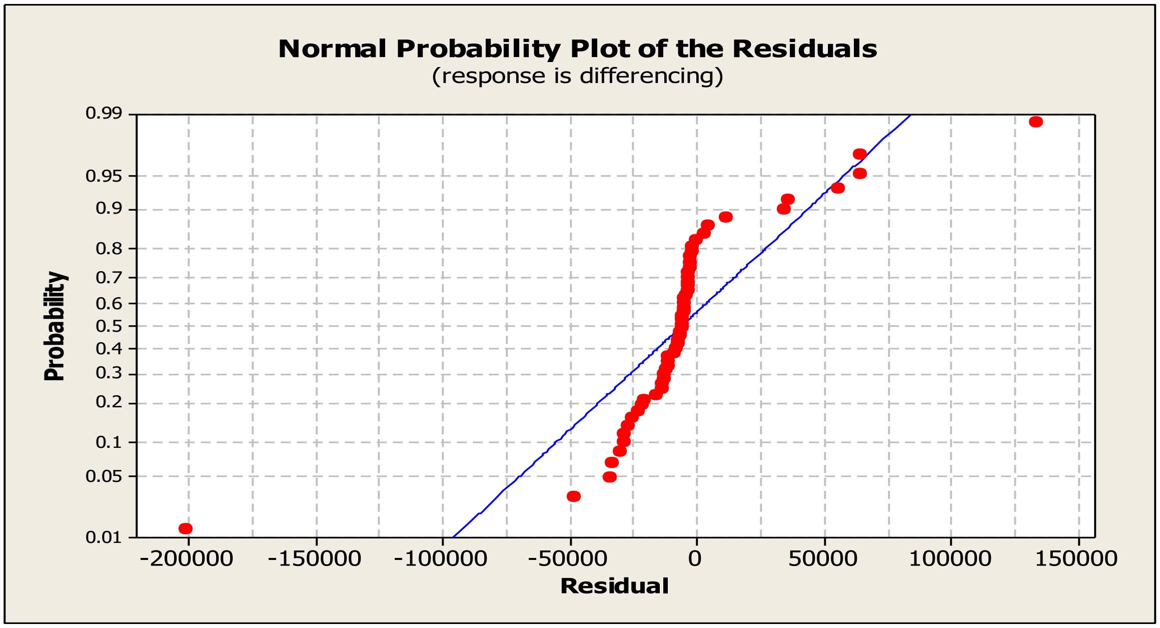
Table 4.6 Box-Pierce (Ljung-Box) Chi-Square statistic test

Lag	12	24	36	48
Chi-Square	1.0	4.1	10.0	10.4
DF	10	22	34	46
p-values	1.000	1.000	1.000	1.000

From the above test statistic (Ljung-Box statistic), since all the p-values are greater than 0.05, so the residual is independent and uncorrelated .This implies that, the selected model ARIMA (1, 1, 1) is an appropriate for egg production.

4.6.5 Residual normality checking

Figure 4.5: normal probability plot of the residuals



The above figure shows that most of the residuals are not much far from the line showing randomness so; this implies that the fitted model ARIMA (1, 1, 1) is an appropriate for the data.

4.8 Forecasting using ARIMA model for egg production data.

Forecasts from period 58

Period	Forecast	Limits 95 Percent Lower	Upper
59	120845	43281	198409
60	115495	18552	212437
61	117658	381	234934
62	116783	-16262	249828
63	117137	-30549	264822
64	116994	-43801	277788
65	117052	-55938	290041
66	117028	-67322	301379
67	117038	-78024	312100
68	117034	-88177	322245
69	117035	-97847	331918
70	117035	-107102	341171
71	117035	-115989	350059
72	117035	-124549	358619
73	117035	-132816	366886

Table 4.7 forecasted value of weekly egg production in Ethio-chicken in gubre subcity.

The forecasted value of egg production in Ethio chicken in Gubre subcity 2021 for 15 weeks will be obtained in the form of the above table.As we have seen from the above table there will be increasing from uniform the beginning of the week that is from 07/31/2021 to 09/05/2021 and after decreasing the week 09/05/2021 to 11/07/2021. Generally, we can understand that the forecasted values of egg production for 2021 will be shows decreasing.

4.9 Discussions

This study was attempted to investigate the trends of actual yield of egg production in case Ethio-Chicken in Gubre Sub-City. The total number of observation which were collected from Ethio-Chicken in Gubre Sub-city were 58 weeks of the egg production data. The results of descriptive statistics revealed that the mean, minimum and maximum egg production in the study area were 220749, 17 and 296592 respectively. To apply Box-Jenkins modeling on a time series data, before any analysis the data should be checked for stationary. As we have seen from the time plot of our original data and By using the ADF and PP test result the original data is not stationary, because p-values of Phillips–Perron test (pp) were 0.4986 which is greater than 0.05 at the 95% level of significance so we do not reject the null hypothesis and concluded that the the weekly egg production data is not stationary. The time series of first difference for egg production is data does appear to be stationary at the first difference (d=1) and The AIC value for ARIMA (1, 1, 1) was less than the other, so this implies that the fitted model ARIMA (1, 1, 1) is an appropriate for the data.

In this study the descriptive statistics revealed that the mean, minimum and maximum egg production in the study area were 220749, 17 and 296592 respectively but,the study done by desta (2015) the mean annual egg production of hen in Haramaya University was 31.42 and ranged from 10.24 - 47.66 eggs which was different from this study.

Using the AIC model selection criterion the selected appropriate ARIMA model for egg production in haramaya university was ARIMA(0,1,1), but in this study the appropriate ARIMA model for egg production in gubre sub-city was ARIMA(1,1,1) contraceptives.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusions

The general objective of this study is to fit time series model and forecast of eggs production at Ethio-chicken in the Gubre breeding farm. We conclude this study to analysis total of 58 weeks of egg production Ethio chicken in Gubre subcity as included in this study.

Since the trend analysis implies decreasing in egg yield there is decreasing performance of egg production in Ethio chiken in Gubre subcity poultry farm in general.

Before applying time series analysis the stationary test of the egg production data were made ,by using the Augmented Dickey-Fuller and Phillips–Peron test and the test's found that the original data not stationary. After the stationary for the data tested the order MA and AR are identified by using the ACF and PACF. Then the model is selected by using AIC .Since, ARIMA (1,1,1) for egg production have lower values of AIC it is found to be the most appropriate model to fit the data of egg production. After the model was fitted the diagnonastic checking have been applied by using the ACF residual and Modified Box-Pierce (Lung-Box) Chi-Square statistic test at 5% level of the significance, so that the model fitted is appropriate for the egg production. Since the linear trend analysis implies decreasing in egg yield there is decreasing performance of egg production in Ethio chiken in gubre subcity poultry farm in general. Further results that there is relatively decreasing of weekly egg production over the forecast period.

5.2. Recommendations

After observing all results of the study, the following recommendations can be made.

From the result of this study the amount of weekly egg production is decreasing from week to week. Even if the study is limited at egg production farm; the concerned body should take the following remedial actions.

The poultry should have to make marketing agreement with owners of lounges and hotels that found in and around gubre subcity. By doing this they can support the economy profit of the ethio chicken company and also meet the customers' requirement regarding egg.

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