

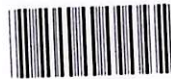
TIME SERIES ANALYSIS OF THE CORN PRODUCTION
IN THE PHILIPPINES

THESIS

JAINA O. MOTAS

College of Arts and Sciences
CAVITE STATE UNIVERSITY
Indang, Cavite

Cavite State University (Main Library)



T6692

THESIS/SP 633.1 M85 2016

December 2016

9/
**TIME SERIES ANALYSIS OF THE CORN PRODUCTION
IN THE PHILIPPINES**

Undergraduate Thesis
Submitted to the Faculty of the
College of Arts and Sciences
Cavite State University
Indang, Cavite

In partial fulfilment
of the requirements for the degree
Bachelor of Science in Applied Mathematics



00011255

*Time series analysis of the corn
production in the Philippines*
633.1 M85 2016
T-6692

JAINA O. MOTAS
December 2016

ABSTRACT

MOTAS, JAINA OÑA. Time Series Analysis of the Corn Production in the Philippines Since 1980 – 2015, Undergraduate Thesis. Bachelor of Science in Applied Mathematics (Major in Statistics). Cavite State University, Indang, Cavite, December 2016. Adviser: Prof. Analyn A. Mojica.

The study was conducted to formulate an appropriate forecasting model for the corn production; test the accuracy of the formulated model; and provide the forecast of the Philippines' corn production for the next five years.

The data used in the study were secondary data of the corn production from 1980 – 2015 in the Philippine Statistics Authority (PSA).

Models were selected using the time series analysis. The best models for the corn production were selected considering several criteria: R-squared, Adjusted R-squared, Akaike Information Criterion, Schwarz Information Criterion, Mean Absolute Percentage Error, Mean Absolute Error, and Root Mean Square Error. The selected best model was the ARIMA (3, 2, 3), and the forecasted values for the corn production were computed using the formulated model equations.

The estimated model for the corn production was:

$$\begin{aligned}\Delta Y_t = & -0.591 \Delta^2 Y_{t-1} - 0.522 \Delta^2 Y_{t-2} - 0.786 \Delta^2 Y_{t-3} - 0.695 \Delta^2 Y_{t-4} \\ & - 0.170 \Delta^2 Y_{t-5} - 0.445 \Delta^2 Y_{t-6}\end{aligned}$$

and the forecasted values were 35279.029 million metric tons, 30536.91 million metric tons, 28347.10 million metric tons, 28713.01 million metric tons, 32300.91 in metric tons respectively.

TABLE OF CONTENTS

	Page
BIOGRAPHICAL DATA	iii
ACKNOWLEDGMENT	iv
ABSTRACT	vii
LIST OF TABLES	xii
LIST OF FIGURES	xiii
LIST OF APPENDICES.....	xiv
INTRODUCTION	
Objectives of the Study	4
Conceptual Framework	5
Significance of the Study	6
Time and Place of the Study	6
Scope and Limitation	6
Definition of Terms	7
REVIEW OF RELATED LITERATURE	
Forecasting	10
Applications of Time Series Analysis	10
Related Studies Involving Time Series Analysis	11
Synthesis	16

METHODOLOGY

Sources of Data	18
Graphical Analysis	18
Descriptive Analysis	19
Statistical Method	19
Test for Stationarity	19
Augmented Dickey Fuller	20
Autocorrelation Function (ACF)	21
Partial Autocorrelation Function (PACF)	22
Importance of ACF and PACF	23
Models for Stationary Model	23
Autoregressive (AR) Model	23
Moving Average (MA) Model	24
Autoregressive Moving Average (ARMA) Model	24
Models for Non – Stationary Time Series	25
Log Transformation	26
Differencing	26
Autoregressive Integrated Moving Average (ARIMA) Models ..	27
Estimation of the Parameter	26
Methods of Moments	28
Maximum Likelihood Estimation	28
Conditional Maximum Likelihood Estimation	29
Unconditional Maximum Likelihood Estimation	29

Sampling Distribution of the Parameter estimates	30
Autoregressive	30
Moving average	30
Autoregressive Moving Average	31
Autoregressive Integrated Moving Average	31
Testing the Significance of the Coefficients	31
Box – Ljung	32
Model Assumptions	33
Test for the Mean of Errors is Equal to Zero	33
Constant Variance	33
Test for Normality	33
Jarque – Bera Test	35
Test for Independence and Homogeneity of Variance	35
Confidence Interval	36
Model fit Statistics	36
Statistical Software Used	39

RESULTS AND DISCUSSION

Graphical Analysis	40
Descriptive Analysis	41
Autocorrelation and Partial Autocorrelation Function	42
Test for Stationary	44
First Differencing	45
Second Differencing	47
Alternative Models	48

Model 1	.....	48
Model 2	.....	50
Model 3	.....	51
Best Model	.....	52
Selected Model	.....	53
Testing for Independence and Constant Variance	.....	54
Test for Normality	.....	55
Forecast	.....	56
Forecast Accuracy	.....	57
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS		
Summary	.....	58
Conclusions	.....	59
Recommendations	.....	59
REFERENCES	.....	60
APPENDICES	.....	62

LIST OF TABLES

Table	Page
1 Critical values for ADF (Fuller, 1976)	21
2 Descriptive Statistics of the corn production in the Philippines	41
3 Testing for Stationary (No differencing)	45
4 Testing for Stationary (1 st Differencing)	46
5 Testing for Stationary (2 nd Differencing)	47
6 Estimation of model 1 parameter	49
7 Estimation of model 2 parameter	50
8 Estimation of model 3 parameter	51
9 Summary of three competing models	53
10 Parameter estimation of the corn production	54
11 Testing the independence and constant variance	55
12 Testing the normality	55
13 Forecasted values of the corn production in the Philippines	56

LIST OF FIGURES

Figure	Page
1 The paradigm of the study	5
2 Time series plot of the corn production in the Philippines	40
3 Correlogram of lag transformed of corn production in the Philippines	42
4 Correlogram of first differencing of corn production in the Philippines	43
5 Correlogram of second differencing of corn production in the Philippines	44
6 Graph of the first differencing of the corn production in the Philippines	46
7 Graph of the second differencing of the corn production in the Philippines ...	48
8 Mean Absolute Percentage Error and Thiel's U Statistics	57

APPENDICES

Appendix	Page
A Corn production data	64

TIME SERIES ANALYSIS OF THE CORN PRODUCTION IN THE PHILIPPINES

Jaina O. Motas

An undergraduate thesis submitted to the faculty of the Department of Physical Sciences, College of Arts and Sciences, Cavite State University, Indang, Cavite in partial fulfillment of the requirements for the degree Bachelor of Science in Applied Mathematics with Specialization in Statistics with Contribution No. T-CAS-2016-P_____. Prepared under the supervision of Prof. Analyn A. Mojica.

INTRODUCTION

Next to rice, corn (or maize, *Zea mays*) is an important food crop in the Philippines, a staple food of 20 percent of the Filipino population, primarily in the southern regions of the Visayas and Mindanao. To the estimated 1 million corn farmers in the Philippines, the crop is also economically important as major ingredient of poultry and livestock feeds and as raw material in many industrial products such as starch oil, artificial sweeteners and organic liquids. The total corn production in 2010 was valued at Php70B (US\$1.7 billion).

Based on 1990-2005 survey, around 22 percent of the total corn supply in the country was consumed as food, 64 percent as feeds, 13 percent for processing into other food product and 1 percent as seeds. The trend is also true for 2011 figures with 63 percent of total supply used for feeds, 21 percent as food, and 13 percent for processing. (Labios R. V., J. Gerpacio, Labios D, R. V. 2004)