ISSN 0798 1015

REVISTA ESPACIOS

HOME | Revista ESPACIOS | ÍNDICES / Index | A LOS AUTORES / To the AUTORS

Vol. 40 (Number 7) Year 2019. Page 15

Green gram weekly price forecasting using time series model

Predicción de precios semanales de la soja verde utilizando el modelo de series de tiempo

PANI Rojalin [1]; BISWAL Saroj K. [2]; MISHRA Uma S. [3]

Received: 29/10/2018 • Approved: 05/02/2019 • Published 04/03/2019

Contents

1. Introduction
2. Methodology
3. Results
4. Conclusion
Bibliographic references

ABSTRACT:
This paper proposes a Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model for forecasting weekly price for Green gram which was taken from the period of January 2004 to July 2018 from AGMARK NET website and evaluates its performance by comparing it with ARIMA models with respect to MAPE criterion. The forecast (With GARCH model) shows the range of market prices of the green gram will be of Rs. 5,350 – 5,577 per quintal during July to September 2018.
Keywords: ARIMA Model, GARCH Model, MAPE

RESUMEN:
Este trabajo propone un modelo *Generalized Autoregressive Conditional Heteroskedasticity* (GARCH) para predecir el precio semanal de la soja verde que se tomó desde enero de 2004 hasta julio de 2018 en el sitio web de AGMARK NET y evalúa su rendimiento comparándolo con modelos de ARIMA con respecto al criterio de MAPE. La previsión (con modelo GARCH) muestra la gama de precios de mercado del gramo verde será de Rs. 5,350-5,577 por quintal durante julio a septiembre de 2018.
Palabras clave: Modelo ARIMA, Modelo GARCH, MAPE

1. Introduction

The green gram (Vigna radiata), alternatively known as the Moong Dal, mash or moong. The green gram is mainly cultivated in India, Burma, Sri Lanka, Pakistan, China, Fiji, Queen's land and Africa. With the total production of about 17 lakh tonnes of grain with a productivity of about 500 kg/ha green gram is getting grown in about 36 lakh hectares (ICAR, Govt. of India). Among 29 states of India; Odisha, Bihar, Madhya Pradesh, Maharashtra, Gujarat, Rajasthan, and Andhra Pradesh are major green gram producing states in India.

Being an excellent source of high-quality protein (25%) and high digestibility green gram is consumed as whole grains as well as "Dal" in a variety of ways in our food. Green gram is a crop which can be cultivated all around the year as it is having five seasons as follows like Kharif (June-September), Pre-Rabi (September-December), Rabi (November-February), Rice fallow (December-March), summer (February-May). As it is cultivated all around the year, there is a great demand for forecasting the prices before the time of sowing as well as harvesting.

In Odisha, the green gram price mainly depends upon the major markets of Nayagrh. Nayagarh is one of the leading markets for green gram in Odisha. The green gram wholesale price in Nayagarh controls a majority of green gram growing areas in the state. There will be an influence in the state price with any fluctuation in market price. So forecasting of price effectively may reduce price volatility with great extent. Price forecasting may help starved farmers to take decision for increasing cultivation area as well as post-harvest storing and selling of their produce. Hence the need for the hour is designing appropriate forecasting model and forecasting price.

1.1. Literature Review

This article applies ARIMA (Autoregressive Integrated Moving Average) model for forecasting of Green gram price for the state of Odisha. This model is most popular for time series forecasting purpose. Applying ARIMA model Darekar and Reddy(2017) forecasted Kharif Paddy price of India from September to November 2017-18; and performance was measured testing AIC, BIC and MAPE; Darekar and Reddy (2017) using Box-Jenkins ARIMA modelling method, forecasted Pigeon pea price in India during November to January 2017-18 and tested reliability of model using goodness of fit methods like MAPE, AIC and BIC; Darekar, A. and Reddy, A. A. (2017) have attempted forecasting of Soybean price India by using ARIMA approach and performance of model got tested using AIC, SBC and MAPE approach; Darekar, A. and Reddy, A. A. (2017) forecasted Cotton price in India using ARIMA modelling method and performance got measured using AIC, SBC and MAPE approach; Ashwini Darekar, A. Amarender Reddy. (2017) suggested farmers to increase acreage under Maize at Suitable condition as the forecasted Maize price (Using ARIMA model) during harvesting season in Indian market from September to December 2017-18 seems to be increasing; Venkatesh Panasa, et al. (2017) forecasted maize monthly modal prices in Telangana, India using ARIMA model with the help of SAS 9.3 software; Hemavathi et al. (2017) forecasted food grains area and production in India using ARIMA model. ARIMA (1, 1, 0) model for forecasting area and ARIMA (0, 1, 1) for forecasting production in India for four leading years; V. Jadhav, et al. (2017) forecasted Maize, Ragi and Paddy of Karnataka state of India for the year 2016. Evaluation of forecast was done using the criteria of MSE, MAPE and Theils U coefficient criteria; Dr V Ramanujam and Dr T Viswanathan. (2018) forecasted Black Peeper price in India; Darekar and Reddy (2018) forecasted Mustard prices in major Mustard producing states of India using ARIMA (0, 1, 0) (0, 1, 1); Darekar A and AA Reddy. (2018) forecasted Wheat price in India using ARIMA (0,1,1) (0,1,1) model.

Tony Guida and Olivier Matringe. (2006) examined the performance of GARCH model in the context of forecasting and observed that non-Gaussian methods are less fitted for agricultural commodities rather than traditional methods of forecasting. S. P. Bhardwaj, et al. (2014) compared the ARIMA model with GARCH model and found that GARCH model forecasting is more accurate than ARIMA model. The GARCH (1,1) model was used for the forecasting of the spot price of Gram. Achal Lama, et al. (2018) studied international cotton price and forecasted the future price using SAS 9.3. During diagnostic checking, it was found that the EGARCH model outperformed the ARIMA model. Na Li. (2016) used NM-GARCH model for forecasting of agricultural commodity price. It was found from the study that corn price is highly volatile.

2. Methodology

The design of the present papper is longitudinal in nature covering Price data of Green gram from January 2004 to September 2018. Secondary data has been collected from AGMARKNET website. The year 2004 is selected as beginning year as before this year some values are missing.

After collection of data Stationarity and normality test is performed to identify Stationarity and normality. SARIMA and GARCH model forecasting for Green gram is compared to get low MAPE (Mean Absolute Percentage Error) value. The lowest MAPE showing model is selected for forecasting for the months of July to September 2018. Data from January 2004 to June 2018 (696 data points) has been selected for future forecasting.

Hypothesis:

H1: The data series are not normally distributed

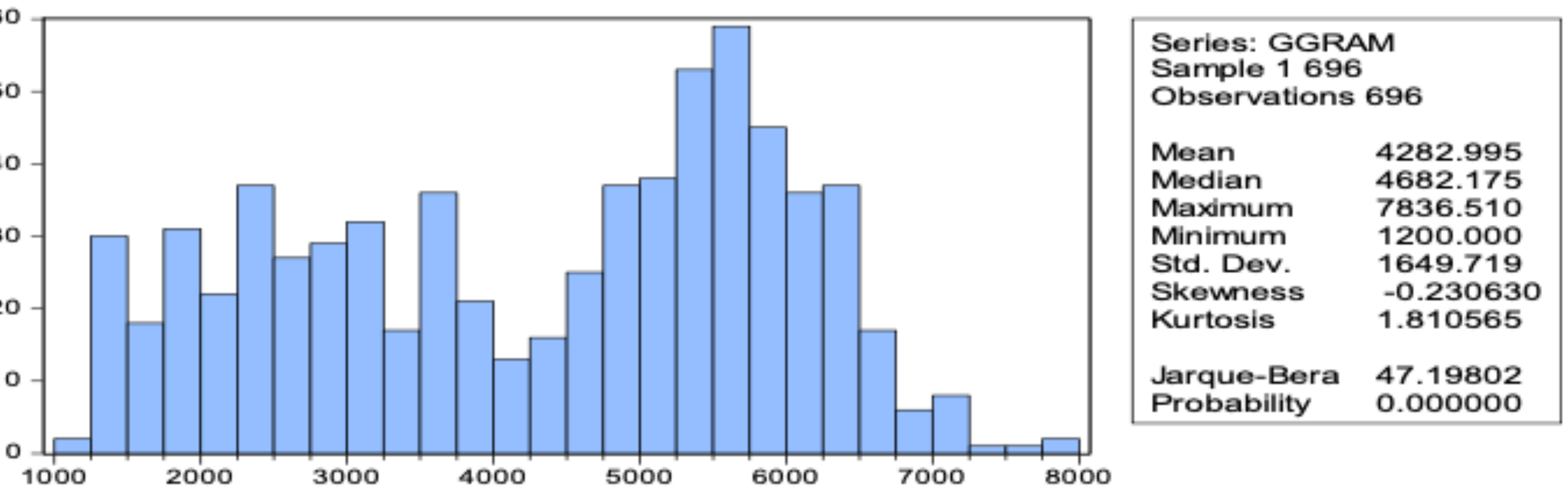
H2: The value of mean and variance remain constant for a specific period of time.

3. Results

3.1. Time Series Analysis of Green gram Price in Odisha Market:

Naygarh is a district in Odisha. Green gram price in Naygarh is important in deciding the green gram market price in whole Odisha. It is the leading green gram markets in the state. The market price is acquired with an increasing trend. The ADF test of time series data was performed, which revealed that the Green gram price was nonstationary. The non-stationary data was made stationary after taking the 1st difference of green gram time series data. A careful examination of ACF and PACF up to 24 lags revealed the presence of volatility in the data. Volatility persistence always refers for continuing with the GARCH model.

Figure 1
Normality Test



From fig-1 it is found that the curve is negatively skewed as the value of skewness is -0.230630; which is supposed to be zero. From the result of kurtosis the value shows 1.810565 which is less than 3. So, it can be said as Platykurtic. As the P-value of JB-test statistics shows 0.0000 which is less than 5%. So, we reject the null hypothesis i.e the data series are not normally distributed.

Stationarity Test

Table 1
ADF Test Result after 1st order difference

t-Value	1%	5%	10%	Probability
Intercept	-3.43968	-2.86555	-2.56896	0.0000
Trend Intercept	-3.97153	-3.4164	-3.13051	0.0000
None	-2.56835	-1.94129	-1.61639	0.0000

From table-1 the P-value was found as 0.0000 which rejects the null hypothesis and accepts the alternative hypothesis i.e the value of mean and variance remain constant for a specific period of time.

Table 2
Comparison of Actual price with Forecasted price

Months of 2018	Weeks	Actual Price	Seasonal ARIMA Price (Rs/Qtl)	APE	GARCH Price (Rs/Qtl)	APE
April	1st week	5669	5913	0.04304	5600	0.0121
	2nd week	5669	6044	0.06615	5578	0.01598
	3rd week	5669	6055	0.06809	5556	0.01986
	4th week	5811	6096	0.04905	5534	0.04759
May	1st week	5811	6146	0.05765	5512	0.05138
	2nd week	5811	6168	0.06144	5491	0.05499
	3rd week	5783	6209	0.07366	5469	0.05432
	4th week	5783	6208	0.07349	5448	0.05795
June	1st week	5649	6191	0.09595	5427	0.03931
	2nd week	5784	6190	0.07019	5406	0.06535
	3rd week	5624	6174	0.0978	5385	0.04257
	4th week	5596	6186	0.10543	5364	0.04154
			MAPE	7.18277	**MAPE**	4.19128

Again to cross check these findings MAPE according to Seasonal ARIMA and GARCH of green gram has been compared. MAPE for SARIMA was found to be 7.18% whereas MAPE for GARCH was 4.19%. Seeing this result we can conclude that the GARCH model is more appropriate than the seasonal ARIMA models in terms of accuracy in forecasting (Table 2).

3.2. Forecasting For the Months of July-September 2018:

GARCH model of forecasting proved to be more appropriate than ARIMA model. Hence, GARCH model has been used to forecast the price of the green gram from July-September 2018. The forecasted price has been shown in Table 2.

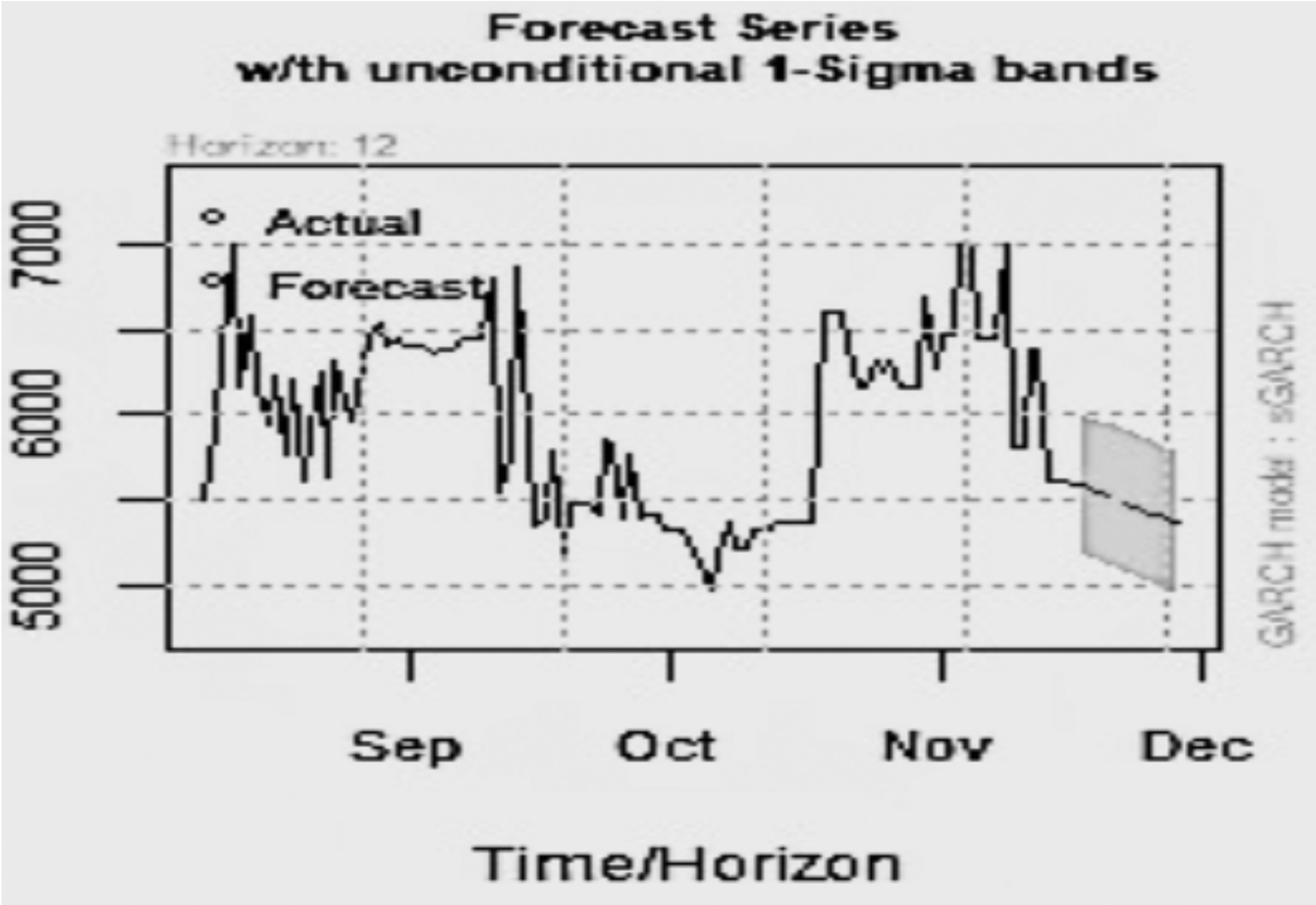
Table 3
Forecasted price for Green gram for the months of July-September 2018

		Forecasted Price Rs/Qtl

Months of 2018	Weeks	(GARCH)
July	1st week	5577
	2nd week	5556
	3rd week	5535
	4th week	5514
August	1st week	5493
	2nd week	5472
	3rd week	5452
	4th week	5431
September	1st week	5411
	2nd week	5390
	3rd week	5370
	4th week	5350

From Table 3 it is concluded that the price of the green gram from the month of July to September 2018 will be ruling over at the range of Rs. 5350-5577 per quintal. In the month of July Price will be Rs. 5514-5577 per quintal. Price for the month of August will dwell within Rs. 5431-5493 per quintal. The price range for the month of September 2018 will be Rs. 5350-5411 per quintal.

Figure 2
Forecasted Time Series Graph of Green gram from July-September 2018



In figure 2 forecasted price of green gram for Odisha market from July-September 2018 has been given.

4. Conclusion

The paper forecasted green gram weekly prices for the months of July to September 2018 by using the price data for historical weekly prices. The paper used a GARCH model for price forecasting. The model may be used successfully for forecasting in the future. Farmers would be helpful from the study in the context of getting maximum benefit by taking a suitable decision on time. The gross returns of the green gram growers may be affected with the wider and frequent fluctuations in wholesale prices. Green gram farmers can be encouraged to continue in producing green gram if they get stabilized price. This is possible with the high degree of fair competition among the wholesale functionaries and traders. Effective dissemination of the market information among the green gram growers in the villages may help in a productive way.

Forecasting the values of an agricultural commodity for future would be helpful for farmers to make the future plans of storing or selling their produce. More often the prices of future are influenced by the historical price and for that reason; most of the forecasting techniques are generally based upon observation of past data. Models of Time Series are always proved as the best models for forecasting future values.

Bibliographic references

Achal Lama. et al. (2015). Modelling and Forecasting of Price Volatility: An Application of GARCH and EGARCH Models. Agricultural Economics Research Review Vol. 28 (No.1) January-June pp 73-82. Retrieved from: https://www.researchgate.net/publication/273776515_Modelling_and_Forecasting_of_Price_Volatility_An_Application_of_GARCH_and_EGARCH_Mod

Ashwini Darekar, A. Amarender Reddy. (2017). Price forecasting of maize in major states. MaizeJournal. Retrieved from: Commodity Profile for Pulses-February, 2018. Retrieved from: https://www.researchgate.net/publication/325755970_Price_forecasting_of_maize_in_major_states.

Darekar, Ashwini. & Reddy, A Amarender. (2017). Price forecasting of pulses: case of pigeon pea. Journal of Food Legumes 30(3): 42-46. Retrieved from: https://www.researchgate.net/publication/323475093_Price_forecasting_of_pulses_case_of_pigeonpea.

Darekar, A. and Reddy, A. A. (2017). Forecasting of Common Paddy Prices in India. Journal of Rice Research, 10(1): 71-75. Retrieved from: https://www.researchgate.net/publication/320806157_Forecasting_of_Common_Paddy_Prices_in_India.

Darekar, A. and Reddy, A. A. (2017). Predicting market price of soybean in major India studies through ARIMA model. Journal of Food Legumes 30(2): 73-76. Retrieved from: https://www.researchgate.net/publication/321856878_Predicting_Market_Price_of_Soybean_in_Major_India_Studies_Through_ARIMA_Model.

Darekar, A. and Reddy, A. A. (2017). Cotton Price Forecasting in Major Producing States. Economic Affairs, 62(3):1-6.Print ISSN : 0424-2513, Online ISSN : 0976-4666, 2017. Retrieved from: https://www.researchgate.net/publication/320482197_Cotton_Price_Forecasting_in_Major_Producing_States

Darekar A and AA Reddy. (2018). Oilseeds Price Forecasting: Case Of Mustard In India. Agricultural Situationin India. Retrieved from: https://www.researchgate.net/publication/325342207_Oilseeds_Price_Forecasting_Case_of_Mustard_in_India.

Darekar A and AA Reddy. (2018). Forecasting wheat prices in India. Forecasting wheat prices in India. Wheat and Barley Research 10(1). Retrieved from: https://www.researchgate.net/publication/325756119_Forecasting_Wheat_Prices_in_India.

Directorate of Marketing & Inspection (DMI), Ministry of Agriculture and Farmers Welfare, Government of India. Retrived from: http://agmarknet.gov.in/.

Dr V Ramanujam and Dr T Viswanathan. (2018). An Empirical Analysis of Forecasting Volatility of Pepper Price in the Spot Market in India. Research Gate. Retrieved from: https://www.researchgate.net/publication/323336718_AN_EMPIRICAL_ANALYSIS_OF_FORECASTING_VOLATILITY_OF_PEPPER_PRICE_IN_THE_SPOT

Green gram (mung bean or moong). Retrieved from: https://kvk.icar.gov.in/API/Content/PPupload/k0447_5.pdf>

Guillermo Benavides. (2018). Price volatility forecasts for agricultural commodities: an application of volatility models, option implieds and composite approaches for futures prices of corn and wheat. Journal of Management, Finance and Economics), vol. 3, n ́um. 2, pp. 40-59. Retrieved from: https://www.researchgate.net/publication.

Hemavathi et al. (2017). Forecasting Food grains Area and Production in India using ARIMA Model. Statistical Approaches on Multidisciplinary Research, Volume I, Surragh Publishers, India, ISSN: 2349 – 4891. Retrieved from: https://www.researchgate.net/publication.

Na Li, et al. (2016). Modelling Regime-Dependent Agricultural Commodity Price Volatilities. Retrieved from: https://www.researchgate.net/publication/318675784_Modeling_regime-dependent_agricultural_commodity_price_volatilities.

S. P. Bhardwaj, et al. (2014) . An Empirical Investigation of Arima and Garch Models in Agricultural Price Forecasting. Economic Affairs, 59(3) : 415-428. Retrieved from: https://ndpublisher.in/admin/issues/EAV59N3i.pdf.

Tony Guida and Olivier Matringe. (2006). Application of GARCH models in forecasting the volatility of agricultural COMMODITIES. SSRN Electronic Journal · January. Retrieved from: https://www.researchgate.net/publication/23744112_Application_of_Garch_Models_in_Forecasting_the_Volatility_of_Agricultural_Commodities.

Venkatesh Panasa, R. Vijaya Kumari, G. Ramakrishna and Kaviraju, S. (2017). Maize Price Forecasting Using Auto Regressive Integrated Moving Average (ARIMA) Model. Int.J.Curr. Microbiol. App.Sci.6(8):2887-2895. Retrieved from: https://www.researchgate.net/publication/319156071_Maize_Price_Forecasting_Using_Auto_Regressive_Integrated_Moving_Average_ARIMA_Model

V. Jadhav, et al. (2018). Application of ARIMA Model for Forecasting Agricultural Prices. J. Agr. Sci.Tech.Vol.19:981992. Retrieved from: https://www.researchgate.net/publication/319245302_Application_of_ARIMA_model_for_forecasting_agricultural_prices.

---

1. Research Scholar, Faculty of Management Sciences, Siksha O Anusandhan (Deemed to be University), rojalin.pani@gmail.com

2. Associate Professor, Faculty of Management Sciences, Siksha O Anusandhan (Deemed to be University), sarojkantabiswal@soa.ac.in

3. Professor, Faculty of Management Sciences, Siksha O Anusandhan (Deemed to be University), umasankarmishra@soa.ac.in, *Corresponding author*
