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Forecast Prices of Iran Agricultural Products: Case Study of Corn and Barley

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Abstract: A focus upon that the predicted price of corn and barley is real, is the main topic of this paper. For this unique view of the adjustment patterns, with a single exponential trend when adjusted linear, harmonic, dissonance to explain conditional variance (ARCH) and explain its moving average (ARMA) was used. Data applied in this study include the actual amounts Producer prices (farm prices head) of maize and barley during the 1954-1987 periods that was extracted from the FAO database for estimating and comparing patterns of data. To investigate the power, Forecast 1985-1987 was used. Results showed that their models explain the exponential moving average and adjusted only when the trend line, respectively, with lower error for predicting the real price of corn and barley than with other methods.

Key words: Price prediction · Mitigation exponential · Harmonic · Dissonance conditional variance to explain · Explain its moving average

INTRODUCTION

Various markets of the world today are a common feature in the future price of the non-pragmatism short and long term [1]. Volatile market agricultural products, not only is the exception rather than other economic sectors with greater risk and uncertainty faced [2]. Risks in agricultural resources can be produced or yield risk, price risk or market risk due to government policies can be divided. On the other hand, the risk in agricultural activities in developing countries caused massive changes in performance and price and according to the performance fluctuations mainly affected by environmental conditions, genetic factors and management is so price fluctuations caused risks Agriculture is in these countries.

This feature for any of these market actors, both seller and buyer, is not good. Based on accurate forecasting of trends and price fluctuations efficient tools for policy decisions in different market levels, investment and marketing is considered. Such importance has led to numerous studies and research on models and forecasting techniques to be done such that it can be patient and Culture Studies noted that when the volatility trend, seasonal cycles and wholesale prices rice in Bangladesh using ARIMA models to predict the harmonic and future prices examined. Harmonic model showed that in addition to seasonal cycles, long-term five-year cycle in the price of rice there. In addition, it was found that the ARIMA model is suitable to predict only short-term price of rice in Bangladesh [3].

Bessler [4] to compare the distribution of subjective estimates by farmers of crop yield and use of past data and model predictions in California, combined payment. His study results showed that the estimated average in the series, ARIMA models with the results estimated by farmers is compatible. Kohzadi *et al.* [5] in a study to predict the price of wheat and live cattle using artificial neural networks and methods ARIMA paid for the period 1990-1950 and found that neural network prediction error is more than ARIMA model.

Tkacz [6] using artificial neural networks, growth of gross domestic product (GDP) of Canada has predicted. Results showed that artificial neural network has less error than the linear model and one variable in forecasting annual GDP growth rate is, however, such excellence in seasonal forecasts to be seen. Gilan Poor and Kohzadi [7] about Price of Thai rice using ARIMA process were anticipated. The results showed that rice prices in international market are not static and the occurrence of any momentum in the market, long-term effects will be followed. Mojaveryan and Amjadi [8] were predicted Citrus prices using common methods of time series and trigonometric functions. Results showed that the

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trigonometric functions to more efficient methods in time series forecasting are out of samples. Abdollahi-Ezatabadi [9] predicted nominal and real prices of pistachio. In this study, regression and prediction methods were compared to non-regression. Results showed that ARCH models with the lowest error are compared with other methods. Jahromi [10] described using their patterns, moving average, single and double exponential adjustment, ARIMA, ARCH harmonic and the nominal and real price of sugar beets were predicted. In this study, the harmonic patterns in comparison with other models based on the RMSE criterion were the prediction error.

The aim of this study was to evaluate and compare the predicted power mitigation methods unique view, zoom adjusted with the process when only linear, harmonic, ARCH, ARMA forecasting the price of corn and barley in Iran. Data used in this study for the period 1954-1987 were collected from FAO databases.

MATERIALS AND METHODS

Several methods for forecasting time series variables, there are two main groups of qualitative and quantitative methods are classified. Quantitative methods can be two categories of non-regression and regression divided. Non-regression techniques, including methods of simple average, moving average and various mitigation methods are exponential. Regression techniques to two groups, Ali and non-Ali are classified. Including regression methods can be the Ali model regression dissonance with conditional variance (ARCH) model and its dissonance regression with conditional generalized variance (GARCH) cited. Ali regression methods include non-harmonic methods and processes are ARMA and ARIMA.

Single Exponential Pattern Adjustment: Moderated view on how much each variable to predict the average amount of weight prediction in a previous period and the error value is predicted to be expressed as following equation [11]:

$$F_{t+1} = F_t + \alpha e_t \quad (1)$$

In the above relationship, F value and the desired forecast variable t time parameter adjustment, which is located between zero and one and is the forecast error. Its value through trial and error so that the minimum error is determined to have predicted the above relationship and if no process to be considered when adjusting only becomes exponential [9].

Exponential Model Adjusted Only When the Trend Line: Single exponential model adjusted with the same linear trend when adjusted exponential model is unique, except that the linear trend when it was added that it can be demonstrated in the following relations.

$$F_t + \alpha.Y_t + (1-\alpha)[F_{t-1} + T_{t-1}] \quad (2)$$

$$T_t + \beta.[F_t + F_{t-1}] + (1-\alpha)T_{t-1}. \quad (3)$$

$$f_{t+h} = F_t + hT_t \quad (4)$$

In the above relations Y_t, the real value of the variable Y in period t and f_{t+h} predicted value for the variable h periods ahead and F_t above the amount forecast at time t, β, α and adjust the parameters and their value is between zero and one.

Harmonic Pattern: Harmonic analysis of time series is essential is that a time series can be done with a combination of amplitude cycles to write the following function [11]:

$$Y_t = \alpha_0 + \alpha_1 \sin(\frac{2\pi t}{p}) + \beta_1 \cos(\frac{2\pi t}{p}) \quad (5)$$

Where, Y_t is the studied time series data, p is the cycle duration, α_1 and β_1 harmonic coefficients or amplitude and t is the time trend. If time series data is to be a time trend variable, they can be related (5) in writing the following:

$$Y_t = \alpha_0 + \alpha_1 \sin(\frac{2\pi t}{p}) + \beta_1 \cos(\frac{2\pi t}{p}) + \gamma + U_t \quad (6)$$

In relation to the above t, the time and U_t represents only the equation, is disturbing.

Harmonic method according to the data daily, weekly, monthly, quarterly and annually, the cycle length can be short term and long-term gain. If annual data are only long-term cycles can be achieved.

During long-term cycles to calculate the estimated function was used, $(\frac{2\pi t}{p})$ and $(\frac{2\pi t}{p})$ significant variables were examined and if at least one of these variables is significant, the amount Y_t calculated and the difference between maxima and minima Y_t are obtained and the difference is that the highest function as a harmonic function and p value in this function as a long term cycle is selected.

ARCH Model: In this model, estimation error can be predicted, but the mark cannot be predicted, including the disruption. In addition, in this method there is similar unconditional variance while variances to the information provided at any time past are dissimilar. If so, the variable y_t is as follows:

$$yt = \beta' x_t + e_t \qquad t = 1, 2... T \tag{7}$$

Which, x_t included 1 × k vector of independent variables is interrupted and β', 1 × k parameter is included, then the ARCH model, including residual random distribution (e_t) with the condition variable information collection is interrupted $\Omega_{t-1} = \{y_{t-1}, x_{t-1}, y_{t-2}, x_{t-2}, ...\}$. Therefore, in general, Engngle [12] is right to assume that such a conditional error distribution is normally as:

$$e_t|\Omega_{t-1} \approx N(0, h_t) \tag{8}$$

$$\upsilon(e_t|\Omega_{t-1}) = h_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i e_{t-i}^2 + \delta' \omega_t \tag{9}$$

In relation to h_t^2 the above e conditional variance Ω_{t-1} and ω vector data sets conditions of predetermined variables is conditional error variance and will affect results. However, subject to the ARCH model is that the estimated model ARCH is effective. For this test, two-stage parasites are used:

$$H_0 : \alpha_1 = \alpha_2 ..... = \alpha_q = 0$$
$$H_1 = \alpha_1 \neq 0, \alpha_2 \neq 0, ..., \alpha_q \neq 0 \tag{10}$$

If the above test H_0 is accepted, the model will be estimated with ARCH effects and thus cannot be used ARCH models, but if H_1 is accepted, the models with ARCH effects and should be used to estimate this model.

ARMA Model: In general, the process (p, q) ARMA states that included among its rank P rank regression and q is such moving average (in other words including order p, including the interruption of the dependent variable and q such times is disturbing). Also, if a time series after differencing d times is making residents and then by the process (p, q) ARMA modeling, we face the original time series, moving average time series regression to accumulate (p, d, q) ARIMA is. In general, a general model (p, q) ARMA is as follows [13]:

$$y_t = \mu + \phi_1 y_{t-1} + \phi_2 y_{t-2} + ... + \phi_p y_{t-p} - \theta_1 U_{t-1} - \theta_2 U_{t-2} - ... - \theta_q U_{t-1} \tag{11}$$

Forecast Power Review: Forecast for power or choosing the best model among different models to measure time series we need the help of the necessary decisions regarding the acceptance or rejection will adopt the model predictions. Different criteria to measure the accuracy of forecasting models exist. In this study, the mean absolute error measures (MAE), Root mean square error (RMSE) and mean absolute percentage error (MAPE) was used. These criteria can be as relations (12-14) [14]:

$$MAE = \frac{1}{n}\sum_{t=1}^{n} |X_t - \hat{X}_t| \tag{12}$$

$$RMSE = \sqrt{\frac{1}{n}\sum_{t=1}^{n} (X_t - \hat{X}_t)^2} \tag{13}$$

$$MAPE = \frac{1}{n}\sum_{t=1}^{n} \left|\frac{X_t - \hat{X}_t}{X_t}\right| .100 \tag{14}$$

N number of forecasts and the actual X_t amount and $\hat{X}_t$ value of the series is predicted.

Random Testing: In general, forecasting models, or based on past trends have been built or they are changing Ali. However, if the modes can be predicted using the above criteria, like long process, short cycle and long-term series exist. Therefore, before using prediction methods must be non-random or random data being examined. Because if these data are random, cannot be predicted from models based on past trends are used [9].

Different tests for study of a random time series, there are non-parametric tests. A non-parametric method to test cycle fluctuations, Wallis method - is Moore. According to the judge if the test is a series of first order difference of the symbol from positive to negative or vice versa will change, with the same series of random type are compared. Before performing the test should also mark the number of periods in random mode is calculated from the relationship and for this purpose (15) are used:

$$U_d = \frac{2(d^2 + 3d + 1)(n - d - 2)}{(d + 3)!} \tag{15}$$

Where, U_d total length d of waiting period in case of accident and n is the number of observations. Function test based on Kai distribution - both as a relationship (16) is:

$$\chi_p^2 = \frac{(u_1 - U_1)^2}{U_1} + \frac{(u_2 - U_2)^2}{U_2} + \ldots \frac{(u_n - U_n)^2}{U_n} \qquad (16)$$

Where u count d period length observed in the number of U-series and discuss the observed period length d is a series of random mode.

If the computational statistics χ_p^2 of less than 6.3, the computational statistics with the statistics table with 2 degrees of freedom compared to. However, if these statistics χ_p^2 are more than 6.3, the statistics for the χ_p^2 degrees of freedom is calculated as 2.5. One of parametric methods to test a series of random time, Durbin-Watson test. The first test for the logarithm of the variable on the variable time is regression. Then, using statistics, Durbin-Watson its existence primarily positive correlation is studied. If its existence is a proven correlation, its being a random series is rejected. However, if this test can be used to approximate the observations are normally distributed.

RESULTS AND DISCUSSION

In this study, using a series of real prices of maize and barley for the period 1945-85 and then estimate the models introduced for the period 1985-1987, which were predicted. Since the regression methods predict static properties are requiring review, so first in terms of their statistical behavior of static test unit roots were examined. Static tests for the price of two variables, was performed by software Eviews6 and the results are given in Table (1).

The results are shown in Table 1. The real price of corn and barley series in static and 10% level are significant. Random variables being investigated as non-parametric test Wallis-Moore and parametric test Durbin-Watson were investigated. The results of these tests in Tables 2-3 are given.

According to the Wallis test, none of Moore's series is not random. Because in all cases, computational χ^2 statistics than the critical χ^2 statistic at 1%. So, zero is based on random variables can be rejected and the price variables are predictable. For random testing of the Durbin-Watson, initially normal test heads when Jarko was investigated for. For this purpose Eviews6 software was used. According to the test series only real cost was normal atmosphere. So the Durbin-Watson test barley was used only for the price. The test results indicated a positive correlation in their series was studied and assume that it is random was rejected. According to the above test results seem both price series, non-random, are predictable and have a cycle fluctuations.

Table 1: Test results of static variables

Variable	Test statistics	Degree of static	Comment
Real price of corn	-3.35*	I (0)	trend - static
Real Price barley	-2.75*	I (0)	W of origin - static

* Significant at 10%, Source: Research findings.

Table 2: Results of random tests Wallis-Moore

Variable	Test statistics	Test result
Real price of corn	351.73**	series is Non-random
Real Price barley	49004.911**	series is Non-random

** Significant at 1%, Source: Research findings.

Estimation of Exponential Model Adjusted Only: This method to determine the amount of adjustment parameter (α), trial and error method was used. For this purpose by changing the values α (0.1- 0.9) Optimum parameter adjustment based on minimum standards was carefully selected and its results are in Table 4.

Estimate the Adjusted Exponential Model with a Single Linear Time Trend: Results of adjusted exponential model predicted only when the trend line is given in the Table 5. This method to determine the amount of adjustment parameters (β, α), trial and error method was used.

Harmonic Estimation Model: In this way p value indicates significant cycle times, or for any of the prices are. In the current study, significant cycle best method of trial and error, respectively. The results in Table 6 are presented.

Results from Table 6, show the sine and cosine cycles real price of corn and barley for nineteen years. Therefore, we can say, behavioral patterns and changes of the actual price of corn and barley, every nineteen years after this last procedure is repeated.

Estimation of ARCH Model: If the ARCH model can be used in the presence of ARCH models is definitive. For this disturbing dissonance sentences variance of variables was examined, the results in Table 7 are presented.

Table 3 Results of random tests Durbin-Watson

Variable	Random being test Jarko-bra	Normal Test Durbin-Watson	Test results
Real price of corn	0.005	25.77	----------
Real Price barley	0.006	3.54	series is Non-random

Source: Research findings.

Table 4: Results of predictions using the model of price adjustment single exponential (t / Season)

		Values (1985)		Values (2007)		Values (2008)	
Variable		Actual	Projected	Actual	Projected	Actual	Projected
Real price of corn	0.6	14666.1	15804.6	17199.8	15121.5	14264.4	16368.5
Real Price barley	0.9	14316.6	15256.9	16427.3	14410.6	23022.3	16225.5

Source: Research findings.

Table 5: Results of forecasting model of price adjustment using single exponential with a linear time trend (t / RLS)

			Values (1985)		Values (2007)		Values (2008)	
Variable			Actual	Projected	Actual	Projected	Actual	Projected
Real price of corn	0.3	0.3	14666.1	18778.5	17199.8	16252.06	14264.4	15527.9
Real Price barley	0.9	0.9	14316.6	14877.6	16427.3	13895.2	23022.2	17975.3

Source: Research findings.

Table 6: Results from the price predicted using harmonic model (t / RLS)

		Values (1985)		Values (2007)		Values (2008)	
Variable	Optimal cycle	Actual	Projected	Actual	Projected	Actual	Projected
Real price of corn	19	14666.1	12051.01	17199.8	18924.08	14264.4	15042.5
Real Price barley	19	14316.6	10242.8	16427.3	17145.7	23022.3	11561.9

Source: Research findings.

Table 7: Test results of ARCH

	Ready to use	
Variable	F	χ^2
Real price of corn	0.361	0.375
Real Price barley	0.000505	0.000053

Source: Research findings

Table 8: Results of using the price forecasting model ARMA (tons / Season)

		Values (1985)		Values (2007)		Values (2008)	
Variable	Process order	Actual	Projected	Actual	Projected	Actual	Projected
Real price of corn	AR(1)	14666.1	15830.2	17199.8	16582.1	14264.4	17023.8
Real Price barley	ARIMA(3,1)	14316.6	15013.6	16427.3	15578.01	23022.3	15509.9

Source: Research findings.

Table 9: Comparison of different methods of forecasting power in the period 1985-87

Variable	Template	MAE	RMSE	MAPE
Real price of corn	Adjusted single exponential	1773.62	1829.62	11.53
	Adjusted single exponential with a linear time trend	2107.89	2543.39	14.13
	Harmonic	1705.83	1863.45	11.103
	AR (1)	1513.7	1765.47	10.29
Real price of corn	Adjusted single exponential	3251.21	4129.04	16.13
	Adjusted single exponential with a linear time trend	2713.31	3276.09	13.75
	Harmonic	5417.56	7034.52	27.53
	ARMA (3,1)	3019.52	4383.42	14.23

Source: Research findings.

Table 10: Forecast Prices of Selected Products with low error model for outside review period Variable

		Climate models		
Variable	Projected price	1988	2010	2011
Real price of corn	AR(1)	15584.7	16362.83	16821.46
Real Price barley	Moderated view only when the linear trend predicted values	14633.81	14680.11	14726.41

Source: Research findings

Results from Table 7, showed that a significant computational statistics is not zero, the absence of ARCH cannot be denied and none of the models with ARCH effects are not. Therefore, in the current study the possibility of using ARCH approach to forecasting does not exist.

Estimation of ARMA Model: As was seen in Table (1), all series in this study are static, so to predict the actual price of corn and barley were used ARMA model. In other words, the true value of d for the price of corn and barley zero were considered.

In the current study to determine rank (p) and moving average (q) based on their charts correlation (ACF) and its partial correlation (PACF), first models with different order of q, p were estimated to ensure suitability of the fitted model, the model waste above unit root test and review the best rank (p, q) based on the smallest amount of care criteria (lowest prediction error) was selected in the results Table 8.

Comparison of Predicted Power: In order to compare the power of prediction models used in this study of the criteria for MAE, RMSE and MAPE were used in the results table 9 is given. Based on these criteria to compare the actual data values 1985-87 periods were anticipated.

According to the results of Table 9, all criteria are accurately stating the ARMA model in forecasting the real price of corn and adjust the exponential model with only linear time trend in real prices predicted climate with less error and thus more efficient than Other models used in this study are. So the real price of corn and barley for the period, respectively 90-1988, using patterns (1) AR and moderate single exponential with a linear time trend was anticipated that the results in Table 10 is available.

CONCLUSION

In this study, different patterns of econometrics to provide appropriate model to predict the real price of corn and barley in Iran was estimated during 1988-1990. To check the power of prediction models using mean absolute error criteria, Root mean square error and mean absolute percentage error was used. Results showed that the actual price forecasts for corn and barley, respectively, models AR (1) and adjusted single exponential with a linear trend when the error significantly less than other methods are more accurate. Finally, using these two methods, the price for three years outside the review period, were predicted. Method AR (1) real price of corn for the years 1988, 2989 and 1990, respectively, 15584.7, 16362.83, 16821.46 Rials per ton predicted. Also based on the unique method of adjusting the exponential trend line when the real price of the atmosphere for years, respectively, 14633.81, 14680.11 and 14726.41 Rials per ton was predicted. According to the results can be presented the following proposals:

- Use of models in planning and policy and market balance in agricultural products by the devices responsible for forecasting economic variables.
- Or a rival method developed for predicting series.
- Smilar study using data instead of monthly and quarterly data because annual crops in determining the price of non-economic factors are inter.

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