Multivariate Model For Forecasting The Wheat Prices In India

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INTRODUCTION

The present study attempts to develop an econometric model for both long-term and short-term forecasting of wheat prices in India. The detailed methodology involved in developing the model and forecasting process can be understood in this paper. The short-term forecasting was studied by using lagged response model, whereas, the long-term forecasting was made with the help of a multivariate model.

METHODOLOGY

The study was carried out to assess the long-term trends in the prices of wheat and factors affecting the wheat prices in India. The investigation calls for data on different variables which affects the prices of wheat in Indian markets. The data on area, yield, production, beginning stocks, imports, exports, and domestic consumption was collected for the period from 1970-71 to 2005-06 from USDA Production, Supply, and Distribution database. The total consumption data includes both the quantity consumed for the purposes of food and feed. The per capita food consumption was taken into account while estimating the total quantity of wheat consumed for food purpose. However, the yearly data on average prices of wheat for India was available only for the period from 1979-80 to 2005-06 and hence, the previous prices were interpolated and included in the analysis. The data on CBOT daily prices have been extracted from MCX Meta stock software and the average annual price of wheat was worked out and used for the analysis.

SELECTION OF MODEL

In the beginning, all the selected variables were included in the model, but due to interrelationship among the independent variables, few variables have been clubbed and used for the analysis. The variables included in the model are: total supply, total demand, minimum support price, CBOT prices and area under wheat cultivation for the whole study period. The total demand includes consumption for food and feed and export, whereas total supply includes imports, total production, and stocks held by both government and private agencies.

To assess the trends in different variables which affect the price of wheat, different forms of equations were used, depending upon their suitability. The equations used are as below:

$$y=a+bt-c_t^2+d_t^3+ut \text{ - For trends in Prices} \quad (1)$$

$$y=a+b_t+u_t \text{ - For Supply} \quad (2)$$

$$y=a+b_t+u_t \text{ - For Demand} \quad (3)$$

$$y=a+b_t-c_t^2+d_t^3-e_t^4+u_t \text{ - For MSP} \quad (4)$$

$$y=a+b_t-c_t^2+d_t^3+u_t \text{ - For Area} \quad (5)$$

Where,

y = Price, supply, demand, MSP and area for respective equations

a= Intercept

b_t, c_t^2, d_t^3, e_t^4 = Coefficients

u_t= Stochastic term

RESULTS AND DISCUSSION

The coefficients, standard errors of the corresponding coefficients, coefficient of determination, and significance of

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the model are presented in Table 1. The predicted variables from the above equations were used to forecast the prices of wheat by using a multivariate model of the following type:

$$\log Y = \log(a)+(b_1)\log X_1+(b_2)\log X_2+(b_3)\log X_3+(b_4)\log X_4+(b_5)\log X_5+u_i \quad \text{——————} \quad (6)$$

Where,

Y = Price of wheat

b_1, b_2, b_3, b_4, b_5 = Coefficients

X_1, X_2, X_3, X_4, X_5 = Independent variables

u_i = Stochastic term

The regression coefficients, standard errors of coefficients, coefficient of multiple determination, and significance of the model can be seen from Table 2. It could be seen from Table 2 that the multiple regression model developed for forecasting the wheat prices was found to be highly significant for the factors like demand, MSP, and CBOT prices. The total effect explained by these variables together was found to be 89%, which seems to be highly significant for price forecasting validated by regression analysis. Model explanatory power is 89% which is good enough to address fundamental factors like demand, MSP, and CBOT prices and rest 11% is explained by other exogenous variables, which we have not included in the model due to lack of data and inability of quantifying some of the variables like climatic factors. The other fundamental factors like area and total supply have negative and non-significant effect. For forecasting the prices of wheat for the years 2007, 2008, 2009, and 2010, the forecasted values of independent variables affecting the prices were taken into account and the predicted and actual trends in the prices of wheat can be seen in Figure 1.

Table 1 : Trends in Selected Variables That Affect the Prices of Wheat (1970-71 to 2005-06)

S.No.	Variable	Intercept	T	T^2	T^3	T^4	R^2	F
1	Price (Y)	4045.49	207.36** (85.81)	-20.34**(5.34)	0.51**(0.095)	-	0.87	76.22
2	Supply (X_1)	26297.68	1692.76**(113.64)	-	-	-	0.86	221.85
3	Demand (X_2)	19937.10	1595.35** (54.91)	-	-	-	0.96	844.01
4	MSP(X_4)	3129.76	592.18** (81.27)	-60.23**(7.07)	1.61**(0.18)	-0.006**(0.06)	0.92	92.30
5	Area (X_5)	16630.50	634.56** (634.56)	-16.50NS(-16.50)	0.18NS(0.18)	-	0.91	110.89

**Significant at 1 per cent level NS Non-significant

Note: Figures in the parentheses indicate the standard errors of the corresponding coefficients.

Table 2: Factors Responsible For Volatility In The Prices of Wheat In India (1970-71 to 2005-06)

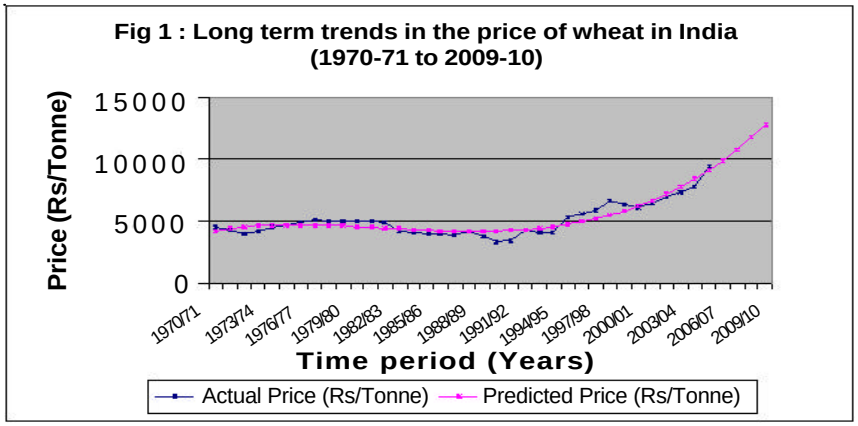
(N=36)

Sl. No.	Independent Variable	Coefficients
1	Total Supply in '000 Tonnes (X_1)	-0.001 ^{NS}(1.12)
2	Total Demand in '000 Tonnes (X_2)	0.28 * (0.12)
3	Minimum Support Price in Rs/Tonne (X_3)	0.98 **(0.07)
4	CBOT Price in $/Tonne ($X_4$)	0.19 **(0.09)
5	Area in '000 Ha (X_5)	-0.20 ^{NS} (0.38)
	Intercept	**-0.82**
	R^2	**0.89**
	'F' Value	**49.95**

**Significant at 1 per cent level *Significant at 5 per cent level NS Non-significant

Note: Figures in the parentheses indicate the standard errors of the corresponding coefficients.

Fig 1 : Long term trends in the price of wheat in India (1970-71 to 2009-10)



LAGGED RESPONSE MODEL

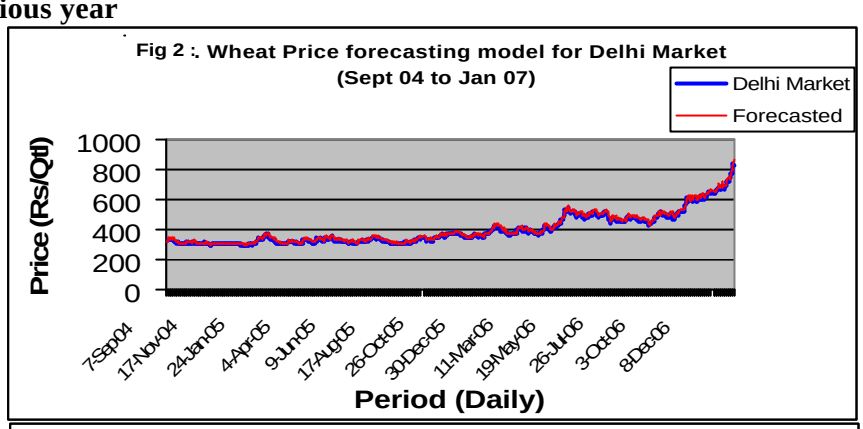
Similarly, by using the available short-term data on Delhi spot prices and CBOT wheat price, the lagged response model of the following type was used by using the daily time series data for the period from September 2004 to December 2006 and August 1973 to August 2007 respectively for Delhi spot prices and CBOT. The results were significant at first lag with high r^2 value of 99 per cent and low Mean Sum of square for error was found to be 120 and 135.5, respectively, which is low, and best fit to address the forecasting ability of the model. The results of actual and predicted prices for Delhi spot price and CBOT respectively can be seen from Figures 2 and 3. The following type of the model was used for forecasting wheat prices:

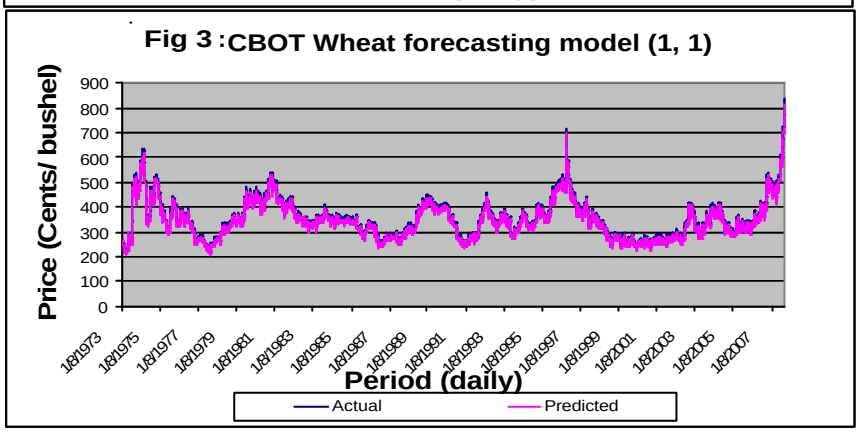
$P_t = f(p_{t-1})$ ——————————— (7)

Where,

P_t = Price of current year

$f(p_{t-1})$= Price of previous year





CONCLUSION

The FTKMC team developed a Multivariate Price Forecasting Model for Wheat with Area, Supply, Demand, Minimum Support Price (MSP), and Global Wheat Prices as variables. Forecast models-both the structural model as well as lagged time series model predicted the prices fairly efficiently. Forecasts for the year 2006-07, 2007-08, 2008-09 and 2009-10 were Rs 9,964, Rs 10,820, Rs 11,752 and Rs 12,764 per tonne respectively. This assumes an average yearly increase in acreage and MSP of 3 percent and 4 to 6 percent respectively (as predicted by the model). However, if there is a less than desired increase in acreage/level of MSP, then there could be shortfall in supply which would have to be met with imports from abroad. The above forecast models are amenable to fine-tuning the predicted prices by incorporation of new and additional information as and when they become available.

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